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ABSTRACT

Two of the largest World Bank investment projects in Bangladesh are the general education project and the female secondary scholarship and assistance project. This paper evaluates the expected results of these educational projects using the household and school survey data recently collected in rural Bangladesh. Bangladesh spends only 2 percent of its GNP on education, compared to 3.2 percent in an average low-income country and 6 percent in an average high-income country. Low investment in education results in low literacy (only 35 percent), which in turn results in low productivity, low incomes, poor health, and, above all, high population growth. To counter these trends, Bangladesh has invested substantially in the education sector in recent years, with the help of the World Bank and other donor agencies. The objective of this investment has been to improve both the quality and quantity of education, especially among the female population. The general education and female secondary school assistance projects are, in particular, geared to promote better access to primary and secondary education, as well as higher school participation and educational attainment. Based on the rural household and school survey data on both supply and demand factors, this report concludes that school interventions such as more and better schools, better trained and educated teachers, more female teachers, and better water and sanitation facilities in schools promote literacy and improve school participation and school attainment rates. Independent of school-level interventions, complementary investments in village infrastructure (roads and electricity) also have beneficial effects on educational outcomes. The effects of all these interventions are more pronounced for girls than for boys. Contains 28 data tables and figures. (Author/TD)

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Education Achievements and School Efficiency in Rural Bangladesh

Shahidur R. Khandker

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Shahidur R. Khandker

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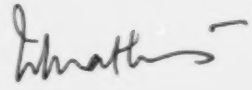
FOREWORD

Education is an important form of human capital that is essential for improving productivity and furthering economic growth. Female education is particularly important for improving health and nutrition and slowing population growth. Promoting investment in education for all and particularly for women is now a well-established development policy. The World Bank is encouraging such investments through lending in developing countries.

Bangladesh, for example, has received substantial World Bank lending for promoting educational investments in the recent past. Two of the largest projects are the general education project and the female secondary scholarship and assistance project. These are expected to help improve the country's literacy rate, which is astoundingly low (35 percent), even when compared to other low-income countries (60 percent).

This paper evaluates, ex ante, the expected results of these educational projects using the household and school survey data recently collected in rural Bangladesh. The findings suggest that school interventions such as better school facilities, more schools, better-trained and -educated teachers, more female teachers and better water and sanitation facilities in schools, all key elements of the Bank-supported educational projects, are critical factors in improving schooling, literacy and school efficiency. Their effects are often more pronounced for girls than for boys. However, complementary investments in physical infrastructure, such as more and better roads, irrigation, and rural electrification, also have independent effects on schooling outcomes by changing the rates of return on schooling.

This is part of the Poverty and Social Policy Department's effort to understand which interventions work best in promoting girls' education.



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ABSTRACT

Bangladesh spends only 2 percent of its GNP on education, compared to 3.2 percent in an average low-income country and 6 percent in an average high-income country. Low investment in education results in low literacy (only 35 percent), which in turn results in low productivity, low incomes, poor health and, above all, high population growth. To counter these trends, Bangladesh has invested substantially in the education sector in recent years, with the help of the World Bank and other donor agencies. The objective of this investment has been to improve both the quality and quantity of education, especially among the female population. The general education and female secondary school assistance projects are, in particular, geared to promote better access to primary and secondary education, as well as higher school participation and educational attainment. This paper assesses whether these interventions can improve the literacy, school participation and school attainment rates. Based on household and school-level data that provide information on both supply- and demand-side factors, the paper concludes that school interventions, such as more and better schools, better trained and educated teachers, more female teachers, and better water and sanitation facilities in schools, all key elements of the Bank-supported educational projects in Bangladesh, are able to promote literacy and improve school participation and school attainment rates. These results are independent of the household- and community-based demand-side factors. More importantly, the effects of these interventions are more pronounced for girls than for boys, which suggests that girls would benefit more than boys from such education projects.

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EXECUTIVE SUMMARY

Besides being a critical development objective in its own right, education is an important form of human capital that improves productivity, health, and nutrition and slows population growth. In Bangladesh -- where per capita income is only $210 and the literacy rate is only 35 percent -- the need to promote investment in education can hardly be overemphasized. In part because of its low income, Bangladesh spends only 2 percent of its GNP on education -- spending that is quite inadequate compared with an average 3.2 percent for low-income countries and 6 percent for high-income countries. Moreover, the resources Bangladesh allocates to education are inequitably distributed across gender and region.

To redress the problems in education, in recent years and with help from the World Bank and other development agencies, Bangladesh has invested substantially in the sector to improve the quality of and access to primary and secondary education and to provide financial incentives (scholarships and stipends) to promote school participation and educational attainment. To assess the potential contribution of such projects, an evaluation of schooling outcomes and school efficiency in Bangladesh is needed. Efforts to improve education in Bangladesh include, among others, the General Education Project (GEP) and the Female Secondary School Assistance Project (FSSAP).

This paper evaluates schooling outcomes at the both household and the school level in rural Bangladesh. At the household level it examines such outcomes as school enrollment, dropout, and attainment in the context of school-supplied inputs along with individual, household, and community variables. At the school level it assesses such outcomes as grade-specific enrollment, dropout, and failure rates in terms of inputs supplied by the government and other sources, along with community-level variables that serve as proxies for the returns to education and, thus, for the demand for schooling. The data used for the study are drawn from a 1991-92 rural household survey and augmented by village- and school-level surveys. Both the household-level and school-level outcomes are regressed on a number of household, village, and school characteristics to identify the possible contribution of different kinds of policy intervention.

Descriptive data analysis shows that children's school performance in rural Bangladesh is astoundingly poor: about 40 percent of children never show up at school, and among those who enter primary school, only 40 percent complete it, and only 7 percent manage to complete secondary school. The gender gap in school participation and primary school completion, although it has decreased, is still high at

the secondary level: among primary school graduates, 74 percent of girls and 84 percent of boys enroll in secondary school, and of these only 18 percent of girls complete it, compared with 29 percent of boys.

Econometric analysis shows that a variety of factors in households, villages, and schools affect schooling outcomes. It also shows that deliberate investment decisions that shape the environment both inside and outside schools can significantly improve those outcomes. For example, increasing household income may, to some extent, reduce the gender bias in the household preference for more education for boys than for girls. Thus, any intervention that leads to higher household income is likely to reduce the gender gap by increasing girls' schooling attainment proportionately more than boys'. But increasing the mother's education has a larger effect on both the school participation and the schooling attainment of girls and, thus, in reducing the gender gap.

Investing directly in schools can improve schooling outcomes in several ways. Because greater proximity to primary school is associated with increased school participation, especially for girls, the government can improve school participation in rural areas through the development of satellite or community schools. Increasing the number of grades offered in a school and improving teachers' training and general education will also improve schooling attainment for both boys and girls. Deploying more female teachers, as proposed in the GEP and FSSAP, improves children's schooling, though more for girls than for boys, especially at the secondary level. Similarly, increasing the availability of toilet facilities and water supply in schools, as proposed in the FSSAP, will contribute more to the schooling attainment of girls.

Complementary investments in village infrastructure, independent of school-level interventions, also have beneficial affects on education. More investment in roads will improve school participation for all rural children, but more for girls than for boys. Rural electrification also increases private investment in education -- and again the effect is more pronounced for girls than for boys. Development of irrigation reduces boys' school participation (because of substitutability between male child labor and hired labor in farming), but increases girls' school participation. In the long run, however, because of its positive effect on income, irrigation improves school efficiency by increasing the schooling attainment of both boys and girls.

A policy simulation exercise shows that increasing mothers' education from the present one year to an average five years would have the greatest impact on children's school participation. But achieving this increase in women's education will require time. Thus, interventions should also be undertaken that promote

better schools (with more female teachers, better-trained and -educated teachers, and better water and sanitation facilities), rural electrification, better and more roads, and the development of irrigation. Such interventions would help improve the efficiency of schools and, thus, schooling outcomes.

1. Introduction

Bangladesh is poor both in per capita income and in human capital. Its annual per capita income is $210, and about 45 percent of its population of more than 115 million lives below the poverty line. Compared with other low-income countries, Bangladesh has a high population growth rate (2.3 percent versus an average of 2 percent) and a low literacy rate (35 percent versus 60 percent).

Raising a population's education levels is one of the most effective ways to improve its productivity, health, and nutrition and slow its growth (for a survey of issues, see Haddad and others 1990). Yet Bangladesh spends only about 2.0 percent of its gross national product (GNP) on education, compared with an average of 3.2 percent for low-income countries and 6 percent for high-income countries. It also allocates its education resources (both private and public) unevenly between males and females and among regions. The female literacy rate (22 percent) is less than half the male rate (47 percent), and the rural literacy rate (20 percent) is less than half the urban rate (45 percent). The gender gap in school enrollment is also astounding: girls' primary enrollment is 78 percent, and girls' secondary enrollment is only 47 percent of boys' enrollment.

Income is perhaps not the overriding constraint to improving schooling in Bangladesh. Although Sri Lanka, for example, is a low-income country, its socioeconomic and education indicators are much better than those of many other low-income--or even middle- and high-income--countries (table 1). Income growth and improved income distribution are certainly important in accelerating educational attainments, but conscious government investment decisions can also help. Keeping this in mind, Bangladesh, with help from the World Bank and other development agencies, has in recent years undertaken education reforms and investments to improve educational outcomes.

The education projects most recently undertaken by Bangladesh with funding from the Bank and other agencies are the General Education Project (GEP), initiated in 1990, and the Female Secondary School Assistance Project (FSSAP), started in 1992. The GEP, whose purpose is to increase the overall efficiency of schools and to improve children's access to primary school, involves the construction and rehabilitation of schools and the development of satellite and informal school systems to reach remote areas and very poor students. Other goals, according to a 1990 World Bank report, are to recruit more female teachers, improve school management systems, simplify curriculums, improve the training,

deployment and supervision of teachers, and expand the existing scholarship program for poor female secondary students. To address constraints to girls' schooling, both inside and outside schools, the project is, according to a 1992 World Bank report, providing girls with stipends to cover expenses from grade 6 through grade 10, improving school sanitary and water facilities, and instituting a skills development program for girls who leave secondary school to seek gainful employment. The purpose of the FSSAP is to reduce the disparity between boys and girls in access to secondary education.

To the extent that inadequate allocation of resources to education and poor distribution of those resources are important causes of low educational attainments, projects such as the GEP and FSSAP can be expected to play a significant role in improving schooling outcomes, through their supply-side effects on the demand for education. But the role of demand-side factors should not be underestimated. Demand for education is influenced by the rate of return to education, and the returns are often influenced by the availability of such complementary inputs as roads, electricity, and irrigation--inputs that represent the demand-side factors in the demand for education.

In affecting schooling outcomes, however, supply- and demand-side factors often reinforce each other in such a way that their separate effects cannot be identified. For example, when a government provides schools of a better quality--an important supply-side factor--it reduces the cost of education to parents (by reducing the inputs they need to supply) and hence increases the demand for it. At the same time, higher school quality improves the returns to education, thus further increasing the demand. In another example, investments in such complementary inputs as electrification and irrigation increase the returns to education and hence the demand for it. The enhanced demand for education in turn increases the demand for better-quality schools and hence for more schooling. The obverse is also true: poor access to or low quality of schools is often linked with low returns to education and, hence, inadequate demand, which jointly produce lower educational attainments.

Thus, what appears to be a supply-side factor may also act as a demand-side factor, and vice versa. Although it is difficult to separate out the precise supply- or demand-side roles played by policy variables that influence schooling outcomes, the reduced-form impact of the variables can be identified. This exercise can help predict the effect of government interventions on schooling outcomes.

The effect of government-supplied inputs and investments on educational attainments can be estimated at the household level using such individual-level educational outcomes as school participation, educational attainment, dropout, and failure. It can also be estimated at the school level using school-level educational outcomes, which can also be used to measure school efficiency.[1] The efficiency or performance of a school is measured by its outputs relative to the inputs provided by the government and other sources. School outputs are measured by such indicators of student performance as test scores or cognitive skills. They can also be measured by such school-level outcomes as grade-specific enrollment, dropout, and failure rates.

The school inputs that affect schooling outcomes at the household or school level are measured by such variables as the number of teachers, their education, and their sex, schools' physical facilities, and schools' instructional materials. Schooling outcomes are also affected by household-level variables, such as parents' education and income, and community-level variables, such as roads, electrification, and other infrastructure.

The role of government in influencing schooling outcomes therefore lies in providing direct inputs to the school system and such indirect inputs as roads and other infrastructure. The efficiency of these publicly provided inputs can be judged by the school-level outcomes, given the community demand for schooling and the cost of the inputs. The effectiveness of government inputs can also be judged by their impact on educational outcomes at the household level.

The purpose of this paper is to document the effects of different policy variables on educational outcomes in Bangladesh. The data used for the study are drawn from a recent household survey that was conducted for a separate study assessing the impact of credit on rural poverty but designed to provide relevant data for analysis of educational outcomes. The data on household-level schooling outcomes were augmented by school- and village-level surveys. Both the household- and school-level outcomes were then regressed on a number of household, village, and school characteristics.

Attempts have been made in the literature to measure the effects of government-provided inputs on schooling outcomes using both household- and school-level data (see, for example, Summers and

[1]School efficiency or effectiveness means here the relation between resource allocation to schools and school-level outcomes such as enrollment, dropout, and failure rates. For related issues, see Lockheed and Hanushek 1988.

Wolfe 1977, Alexander and Simmons 1978, Cochrane and Jamison 1982, Fuller 1987, and Jamison and Lockheed 1986). Such identification of program effects is problematic for two reasons, however. First, the household- or school-level education effects of government interventions through schools may overestimate the program effects if program placement is endogenous; that is, the estimates will be biased if the distribution of program inputs is not random because households have located according to the perceived quality of a school as reflected in public investments (Rosenzweig and Wolpin 1986).[2] Second, societal expectations (unobserved to econometricians) about schooling may differ for boys and girls and from grade to grade. This may also bias the allocation of resources both private and public, and consequently bias the estimated effects of public interventions.

Estimates of the effects of government inputs on schooling outcomes thus may suffer from unobserved-variable bias. In estimating the effects of government interventions in rural Bangladesh, this study assumes that households do not locate based on unobserved school characteristics,[3] and therefore, that program interventions may be distributed randomly by the government and may be given for the household decision making process.[4] But even in rural areas unobserved parental or societal expectations about schooling may differ for boys and girls and between grades; these differences, unless controlled for, may bias the estimates of schooling outcomes. This bias, although it cannot be reduced in cross-section analysis of individual- or household-level data, is controlled for by using a grade-specific fixed-effects technique in the school-level outcomes regression.

This paper first presents a descriptive analysis of schooling achievements at the household level in Bangladesh and then discusses educational outcomes at the school level. It presents a model framework for analyzing the effect of relevant policy variables on both the household-level and the school-level education outcomes, and then gives the estimates of these outcomes. The estimates of school-level outcomes provide a measure of school efficiency in terms of the effectiveness of government inputs in determining these outcomes. The paper then gives the results of a policy simulation exercise,

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[2]Thus, it is difficult to identify whether the impact of school inputs on students' achievements--for example, in terms of schooling attainment--is due to program effect or the unobserved ability effect of students or parents.

[3]This may not be a bad assumption for rural Bangladesh. In urban areas, however, households might locate according to the perceived quality of schools.

[4]But even then the estimates may be biased due to unobserved individual ability. To control this requires individual panel data or some measure of ability.

which suggests ways in which the government can improve schooling outcomes and school effectiveness in rural Bangladesh. It concludes by summarizing the findings and discussing policy options for increasing human capital in Bangladesh.

2. The household and school surveys

A multipurpose household survey was conducted in eighty-seven villages of twenty-nine thanas in Bangladesh during the year 1991-92. Although the survey's main focus was to provide data for an analysis of the credit and other input effects of three major credit programs (Grameen Bank, Bangladesh Rural Advancement Committee, and the Rural Development-12 program of the Bangladesh Rural Development Board), the survey also provided data for the study of schooling achievements and school efficiency in rural Bangladesh. The survey covered primarily target households (those owning less than half an acre of land and thus eligible to participate in any of the three credit programs), but also included nontarget households to augment the data on schooling.

The sample consists of 29 thanas randomly drawn from 391 thanas in Bangladesh (after excluding the south and southeastern thanas that were severely affected by a devastating cyclone in April 1991). In 24 of the 29 thanas selected for the study, at least one of the three credit programs under study is in operation; in 5 thanas none of the programs is operating. The program thanas are distributed among four regions--8 thanas in Khulna region, 3 in Chittagong region, 10 in Dhaka region, and 8 in Rajshahi region.[5]

Three villages in each program thana were then randomly selected from a list of program villages supplied by the program's local office. The criterion used in selecting the program villages was that the program must have been in operation in a village for at least three years. In addition, three villages in each nonprogram thana were randomly drawn from the village census of the government of Bangladesh. To prevent the selection of unrepresentative villages, exclusion restrictions were imposed:

(1) If the number of households in a village was between 51 and 300, the village was accepted for random drawing.

[5]Because more than a third of the Chittagong region was devastated by the 1991 cyclone, only a few thanas are drawn from that region.

(2) If the number of households in a village was between 301 and 600, it was also accepted as a single village, but the household census was started in a randomly selected corner of the village and stopped after about 200 households had been covered.

(3) If the number of households in a village was less than 50 or greater than 600, the village was replaced with another that satisfied 1 or 2.

From the village census list of households, 20 households were drawn from each program and nonprogram village for the in-depth household survey. The distribution of these 20 households by target and nontarget groups was 17:3 in each program village and 16:4 in each nonprogram village. A random sampling technique was used to draw the required sample of 17 target households from the nonprogram villages as well as the sample of 3 nontarget households from both program and nonprogram villages.

Because the survey design required a sufficient number of program participants among the target households, a simple random technique could not be used to draw the target households in program areas. Instead, a stratified random sampling technique was used to draw these households in the ratio of 14:6 (14 participants and 6 nonparticipants).[6]

Appropriate weights are then needed to correct for the stratified sample distribution. Note that households are stratified based on the distribution of households, not on the distribution of individuals. This paper analyzes educational outcomes for individuals, as measured by such indicators as school enrollment, attainment, dropout, and failure rates. Weighted averages of educational outcomes were generated using the appropriate weights (sample household distribution weighted by village household distribution by target and nontarget households) at the individual level, for comparison with unweighted

[6]The sample size and the ratio between participant and nonparticipant households differ in five program thanas (two for Grameen, two for BRAC, and one for BRDB) selected for the nutrition survey. In each nutrition study thana the number of the target households drawn was higher than 17, although the number of nontarget households drawn remained the same (3). Thus, in each Grameen and BRAC nutrition thana 20 households were drawn from the target households for a ratio between participating and nonparticipating households of 16:4. In contrast, for the BRDB nutrition thana 25 target households were drawn, with a ratio between participating and nonparticipating households of 18:7.

averages. The results show little difference between these two sets of averages.[7] Therefore, for its analysis of schooling, the paper treats the sample as random and uses no weight to adjust data.

In addition to the general household survey that collected information on households' and individuals' income, employment, education, health, consumption, borrowing, savings, and so on, questionnaires were also administered to collect data at the village and school levels. The village questionnaires collected information on infrastructure, prices, wages, and the like. The school questionnaires collected information on school performance, such as grade-specific enrollment, dropout, and failure rates, and on the quantity and quality of school-supplied inputs, such as the number of teachers and their gender composition, teachers' education levels, and schools' water and sanitation facilities. The survey covered all secondary and postsecondary schools of each thana that were being or had been attended by members of households selected for the study, but only those primary schools located in any of the three villages surveyed.

3. Household-level schooling outcomes: Stylized facts

A descriptive analysis of schooling outcomes at the individual level was performed using data from a multipurpose household survey conducted in 1991-92 in four regions of Bangladesh--Chittagong, Dhaka, Khulna, and Rajshahi. The survey, conducted primarily to test the effects of three credit programs, covered 1,798 households in eighty-seven villages of twenty-nine thanas. Of the households surveyed, 1,538 were targeted by one of the credit programs and 260 were not. Among the target households, 905 households, about 59 percent of the targeted households sampled for the study, participated in any of the programs. The ratio of program participants to nonparticipants in the villages covered in the study is 44:66. Participating and nonparticipating households were not differentiated for the analysis of schooling outcomes, however, because program participation depends on asset ownership and the asset distribution is assumed to be given for this analysis.[8]

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[7] For example, the unweighted average school attainment is 3.87 years, compared with a weighted average of 4.23 years. Similarly, the weighted average of school participation is 0.47, compared with an unweighted average of 0.45. The difference between weighted and unweighted averages is minimal because the ratio of individuals in the nontarget households to those in the target sample households is high, offsetting the overdrawn size of the ratio of target to nontarget households. In fact, weighted data analysis does not produce results quite differently from what we produced here without weights.

[8] However, program participation may influence schooling outcomes if it is endogenous. This aspect is not examined here.

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The descriptive analysis of individual schooling outcomes covered school participation (enrollment) rates, schooling attainment, and school transition and completion rates by level--primary, secondary, and postsecondary.[9] The descriptive analysis shows that the overall schooling performance of children in Bangladesh is poor and must be improved in order to reap the benefits of an educated labor force. The findings are broken down by sex, age-group (all ages and age 5 - 20), and region.

The school participation rate is defined as the percentage of individuals who have ever been in school. Overall, 58 percent of all males had ever attended school, compared with 41 percent of all females (Figure 1). Among the younger cohort (age 6 to 20), the school participation rate is higher than in the population as a whole for both males and females, but the difference is much greater for females than for males. Among those under 20, about 64 percent of males had ever attended school, compared with 57 percent of females. Thus, the participation rate is about 10 percent higher for men, and 39 percent higher for women in the younger cohort than in the total population. This finding clearly suggests that school participation among young children has increased, especially for girls.

The school participation rate varies by region however. Among the younger cohort, the school participation rates of males and females are the highest (84 and 72 percent) in Chittagong region and the lowest (51 and 46 percent) in Rajshahi region. In all regions and for all cohorts the participation rate for males is consistently higher than that for females. Among girls of the younger cohort, those in Rajshahi region did better than their counterparts in other regions relative to the older cohorts.

Schooling attainment, which is measured by the number of years of education completed, is also higher for males than for females. In rural Bangladesh, among those of all ages who have ever attended school, males complete five years of education on average, compared with four years for females (Figure 2). Schooling attainment for males of all ages is highest (5.4 years) in Dhaka region and lowest (about 4.8 years) in Khulna and Chittagong regions. Among women of all ages, schooling attainment is highest (4.6 years) in Rajshahi region and lowest (3.8 years) in Chittagong region.

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[9]The formal education system in Bangladesh includes five years of primary education, seven years of secondary education (three years of junior secondary school, two years of secondary school, and two years of higher secondary school or intermediate college), followed by two to five years of postsecondary school. Because there were too few observations at the postsecondary level, the postsecondary school data were merged with those of secondary schools for the descriptive data analysis.

To the extent that those under age 20 are still in school, the schooling attainment of children age six to twenty is incomplete. It is therefore instructive to look at the percentage of students of different ages who are still in school to see whether there are any marked differences in the survival patterns of students (age six to twenty) by age and by sex. Figure 3 shows that among children age six to twenty who ever attended school, the dropout rate is higher for girls than for boys after age 10 in all regions except Dhaka. In that region the dropout rate for those age 12 to 16 is higher for boys, although after age 16 it is higher for girls.

Figures 4 and 5 present the survival probability of males and females by grade in terms of the probability of failure in each grade.[10] The gender gap in schooling attainment for all ages is lowest in Dhaka region and highest in Rajshahi region. Alternatively, the survival probability is higher for girls in Dhaka than in other regions, given the survival probability for boys. The gender gap in schooling attainment increases after grade 6 in all regions, but then shrinks after grade 10 in all regions except Rajshahi.

Interestingly, the gender gap in schooling attainment, given school participation, is lower among the younger cohort than among those of all ages even after grade 6 (figure 5). But the gender gap in schooling attainment remains higher in Rajshahi compared with other regions even among the younger cohort.

Schooling attainment is further disaggregated by education level in figures 6 and 7. On average for all age-groups, 51 percent of males who ever attended school completed the primary level, and only 12 percent completed secondary school. In contrast, some 45 percent of females of all ages who ever attended school completed primary school and only 5 percent completed the secondary level. The primary completion rates for both males and females are highest in Dhaka (56 percent for males and 51 percent for females) and lowest in Khulna region (47 percent for males and 39 percent for females), and also for males in Chittagong region.

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[10]The survival probability is defined on the proposition that the students survived at each grade among those who enter into the grade. The survival probability is calculated based on the Kaplan-Meir Product limit method which estimates a descending step function where each of the descending legs indicates one or more dropouts. For details, see Cox and Oakes (1986).

The school completion rate is lower at all levels for the younger cohort, possibly because of incomplete schooling (figure 7). About 39 percent of males and 40 percent of females in the younger cohort completed the primary level, compared with 51 percent of males and 45 percent of females of all ages. As these data show, in the younger cohort girls outperform boys at the primary level; however, the secondary completion rate for girls (5 percent) is half that for boys (12 percent).

The primary school completion rate of boys is highest (47 percent) in Dhaka region and lowest (33 percent) in Rajshahi region. For girls it is highest (46 percent) in Dhaka region and lowest (32 percent) in Chittagong region.

The overall schooling attainment or completion rate is greatly influenced by the transition rate, defined as the percentage of children who, after completing a particular cycle of education move on to the next cycle. At the country level, some 24 percent of males of all ages who completed the primary cycle moved on to the secondary cycle, compared with only 12 percent of girls (figure 8). This rate has not changed over time: the transition rates for both males and females of the younger cohort are similar to those for their counterparts of all ages (figure 9). At the postsecondary level, transition rates are generally higher among girls than among boys. At the country level, some 32 percent of females of all ages, who complete the secondary level move on to the postsecondary level, compared with 25 percent of males (figure 8). And for girls of the younger cohort, the transition rate at the postsecondary level is 28 percent, compared with only 9 percent for boys (figure 9).

Transition rates vary dramatically by region. For example, for female students age 6 to 20 who complete secondary schooling, the transition rate to the postsecondary level is 50 percent in Rajshahi and zero in Khulna region (figure 9).[11]

To show how the findings presented above translate into rural childrens' school performance at different levels, we follow a fictitious group of 100 males and 100 females of each age-group and compute, based on the enrollment, attainment, completion, and transition rates, the number remaining in the school system at each level (table 2). Although there are substantial differences between males and females at all education levels, the gender gap has been reduced among the younger cohort. Among

[11]There may be a small-sample bias in this group.

individuals of all ages, 58 percent of males but only 41 percent of females enroll in school, while among the younger cohort 64 percent of boys and 57 percent of girls enroll.

Of those who enrolled in primary school, 52 percent of males and 44 percent of females of all ages completed it, compared with 39 percent of boys and 40 percent of girls in the younger cohort. Among the primary school graduates, 73 percent of males and 61 percent of females of all ages, and 84 percent of boys and 74 percent of girls in the younger cohort enroll in secondary school. Of these secondary school enrollees, 32 percent of males and 18 percent of females of all ages, and 29 percent of boys and 18 percent of girls of the younger cohort completed secondary school. That is, among those who enroll in primary school, only 12 percent of males and 5 percent of females of all age-groups complete secondary school. The school performance of the younger cohort is slightly better than that for those of all ages.

4. School-level outcomes: Stylized facts

As part of the household survey 687 schools were surveyed to provide data to match with the schooling data on all those in the surveyed households who were attending or had completed school. The school survey data were used to produce stylized facts, presented in this section, about the grade-specific outcomes, by sex and region, of the primary and secondary schools surveyed. These school-level data were also used, along with household-level schooling outcomes, to analyze the efficiency of government-supplied inputs in schooling outcomes; the results are presented below in the section on estimates of school-level outcomes.

In both primary and secondary schools the grade-specific enrollment, as a percentage of total school enrollment, is higher for both boys and girls in lower grades than in higher grades in all regions (figures 10 and 11). The grade-specific enrollment at different grades varies little between boys and girls.

The decline in enrollment at higher grades varies slightly by region, perhaps because of differences in grade-specific dropout rates. For example, in Dhaka region the first-grade enrollment is 34 percent of all boys and 35 percent of all girls enrolled in primary school; fifth-grade enrollment declines to 16 percent of boys and 15 percent of girls (figure 10). In the sixth grade, the beginning of

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the secondary school cycle, in the same region the enrollment is 26 percent of boys and 30 percent of girls, and in the tenth grade it is 15 percent of boys and 14 percent of girls (figure 11).

The grade-specific dropout rate, defined here as the proportion of students enrolled in a particular class in 1992 relative to the enrollment in that class in 1991,[12] suggests that, in most of the regions, the higher the grade level, the higher the dropout rate is (figures 12 and 13). In all regions the dropout rate at each grade is higher for girls than for boys. The female dropout rate at the fifth grade is highest in Khulna (25 percent) and Rajshahi (27 percent) regions and lowest in Chittagong region (9 percent). At the secondary level the female dropout rate in each grade is highest in Khulna and Rajshahi regions and lowest in Dhaka region.

Part of the grade-specific dropout rate can be traced to the grade-specific failure rate, defined here as the proportion of students enrolled in the 1991 class who have failed. The failure rate is higher for students in higher grades than for students in lower grades in both the primary and the secondary school cycles, and in general it is higher for girls than for boys (figures 14 and 15). Failure rates vary remarkably by region, however, especially at the secondary level (figure 15). The failure rate for tenth-grade girls is highest in Khulna (10 percent) and Rajshahi (9 percent) regions and lowest in Chittagong region (3 percent).

5. Schooling outcomes: Household model specification

Both the household-level and the school-level outcomes show low retention and high dropout rates, especially among girls. To determine whether these outcomes can be improved through government interventions in education and other sectors requires an understanding of the process through which households make decisions on schooling, which is, after all, a household level choice variable. An understanding of the household decision making process will help in identifying the roles that different factors, including the government, play in this process.

A schooling outcome such as enrollment or educational attainment is the output of home-based, nonmarket production. Yet it is influenced by inputs supplied not only by households, but also by the

[12]This rate can only be an estimate, as some students may transfer from one school to another.

market and the community. Parents, because they initiate the demand for schooling, are the key players in determining schooling outcomes, and their incomes and education matter most. Also critical is the price structure that parents face in demanding schooling for children. The price of schooling is determined by a host of factors, including the quantity and quality of school-supplied inputs (for example, school location and number of classes and teachers) and community characteristics, such as roads, that determine schools' accessibility. The community environment, as proxied by such variables as irrigation and electrification, also affects schooling outcomes--by determining the returns to education and thus the demand for it.

An element of the community environment that has an important effect on schooling outcomes, given the high incidence of poor health among schoolchildren in developing countries, is adequate sanitation and a good water supply. Improved water supply and sanitation facilities can directly affect schooling outcomes by improving children's health and hence their cognitive achievements and by increasing the efficiency of the use of time in schooling and other activities. Improvements to water supply and sanitation facilities also have an indirect effect on a child's schooling outcomes through their impact on the health of other family members. This effect is especially important for girls, who are often responsible for the care of family members who are ill.

It is through interventions that affect such elements of the school and community environment, as well as the price structures of goods and services that households consume, that the government can play an important role in influencing schooling outcomes. Although estimating the effects of these variables on schooling outcomes is difficult because of the complex relationship among them, it is nevertheless feasible--and it is essential for designing effective polices to influence those outcomes. To help in understanding the possible interactions among the variables and their estimation, the underlying household decisionmaking process is modelled here, based on children's health, education, and expected earnings.[13] The strategy for estimating the model is then discussed.

[13]The purpose of this section is to justify the inclusion of certain variables in an estimated model and to provide an economic interpretation of their coefficients. Variables are often included in estimated models that are difficult to justify. To avoid this kind of problem, a household model is developed. A general discussion of the household model can be found in Singh, Squire, and Strauss 1986.

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Household decisionmaking model

Assume that parents, consisting of a mother (m) and a father (f) with preferences Γ^m and Γ^f and a combined income (I) net of consumption, decide how much health care and schooling will be allocated to their children; this, in turn, determines the children's expected lifetime earnings.[14] Parents care about the investment in their children because it yields utility (U) directly to them. The utility function of the parents can be written as:

$$U = U(S, H, R, L; \Gamma^m, \Gamma^f) \tag{1}$$

where S is the schooling, H the health, R the expected earnings and L the leisure of their children. As equation 1 shows, the curvature of the utility function is influenced by the parents' preferences, Γ^m and Γ^f.

Both schooling and health are outputs of home-based, nonmarket production that uses both market-purchased and home-provided inputs, given the technology of production and the environment in which the household production takes place. The production function of schooling is given by:

$$S = S(M, H, K; \alpha) \tag{2}$$

where M is a vector of market-purchased inputs, such as books, papers, and pencils, H is the children's health status, K is the "effective" time children devote to schooling, and α represents the school environment, such as number of teachers, number of classes, whether the school has a water supply and toilet facilities, and whether the school is coed. Equation 2 states that, given the technology and school environment, the health status of children directly affects their schooling outcomes. But children's health (H) is in turn produced with market-purchased inputs (Z) in a health environment summarized by τ, given the household production technology. The production function for health is given by:

$$H = H(Z; \tau). \tag{3}$$

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[14]For simplicity, we assume that the number of children, male and female, is given--in other words, that it is not a choice variable. Doing otherwise would only complicate the model and its estimation. For example, family planning programs that affect fertility outcomes would also influence children's schooling and health outcomes.

Parents' ultimate objective in giving their children better schooling and health is to help children maximize their expected lifetime earnings (R). Children's expected earnings are therefore assumed to be directly influenced by schooling (S) and indirectly influenced by health status (H), given the productive environment as summarized by σ. Productive environment here means the productive potential of the local area. The productive potential in a rural setting may be represented by the extent of irrigation and electrification and the availability of other infrastructures. The children's expected earnings function is given by:

$$R = R(S; H, \sigma). \tag{4}$$

The earnings equation (4), assumes that children's health status (H) and productive environment (σ) affect the earnings effect of schooling, but do not directly affect earnings. That is, better health and a productive environment only influence the productivity effect of schooling.

The health status of children also affects the quality of time (N) devoted to schooling, which is given by:

$$K = K(N, H). \tag{5}$$

The "effective" time (K) devoted to schooling is thus directly affected by children's allocation of time to schooling and by their health status.

Because improved health status can increase an individual's total time available, Σ (see Grossman 1972), and since children in a rural setting where the labor market is not perfectly competitive can alternatively allocate their time to income generation for parents at some remuneration π, the children's time constraint can be written as:

$$Y + L + N = \Sigma(H) \tag{6}$$

where Y is time spent on current income generation for parents.

The parents' budget constraint is then given by

(7) $$P_M M + P_Z Z = I + \pi Y.$$

The first-order conditions, derived from the maximization of equation 1 subject to the structural conditions of equations 2 through 7, for the optimal amounts of the market-purchased inputs (M and Z) used in the production of schooling and health and of the time spent on schooling (N) and leisure (L), are given by:

(8) $$(U_S + U_R R_S) S_M = \Phi P_M$$

(9) $$[(U_H + U_S + U_R R_S)(S_H + S_K K_H)] H_Z = \Phi(P_Z - \pi \Sigma_H H_Z)$$

(10) $$(U_S + U_R R_S) S_K K_N = \Phi \pi$$

(11) $$U_L = \Phi \pi$$

where Φ is the marginal utility of income which is positive.

Equations (8) and (9) state that, in order to obtain the optimal utilization of inputs in school production, the relative productivities of inputs M and N in school production must be equal to the ratio of their respective prices--that is,

(12) $$S_M/(S_K S_N) = P_M/\pi.$$

Equations (8) and (9) also state that the use of market-purchased inputs (M) and children's time spent on schooling (N) depend not only on how parents value children's schooling and expected earnings, but also on the expected return to children's schooling. In equation form, this may be written as:

(13) $$U_S = \Phi(P_M/S_M) - U_R R_S = \Phi(\pi/S_K K_N) - U_R R_S$$

Similarly, equation (9) implies that parents' investment in children's health is influenced in part by the return to children's education and alternative uses of time for current income generation. Improved health can reduce the shadow prices of health inputs (Z) because it directly increases current income, increases the number of healthy days available that have alternative use in augmenting parents' income,

and reduces the cost of producing schooling by improving efficiency. In equation form, this can be written as:

$$U_H = \Phi A/(S_H + S_K K_H)H_Z \tag{14}$$

where $$A = \{P_Z - \pi[\Sigma_H + 1 + (S_H/S_M)P_M]H_Z\}$$

is the shadow price of producing health for children.

On the other hand, equations (10) and (11) imply that parents' marginal utility from children's leisure must be equal to their marginal valuation of children's time in alternative uses, such as income generation to augment parents' income.

The reduced-form equation for childrens' schooling is given by:[15]

$$S^* = D^i(P_M, P_Z, I, \pi, \alpha, \gamma, \sigma, \Gamma^m, \Gamma^f) \tag{15}$$

The explanatory variables in the schooling outcomes equation are prices (P), household income (I), parental preferences (Γ), current opportunity cost of children's time in schooling (π), school environment (α), health environment (γ), and productive potential (σ), all of which are considered exogenous to parents' investment decisions.

Strategy for estimating the model

The causal impact of many policy variables is difficult to quantify a priori because of their complex interactions with household decisionmaking and observed behavior. An empirical application of this theoretical framework, however, can shed light on the magnitude and the significance of the effects of supply- and demand-side factors on schooling outcomes. Using the household, community, and school survey data in the next section I estimate the reduced-form schooling outcomes equation (equation 15) for the household-level schooling outcomes, which incorporates the effects of all variables considered

[15]Similar reduced-form equations can be derived for health, leisure, and earnings.

exogenous to household decisionmaking. In the following section I also estimate an aggregate schooling outcomes equation (a reduced-form equation similar to equation 15) by using the school-level inputs and outputs, after controlling for the demand for schooling at the community level. The school-based exercise provides estimates of school efficiency, and the household-level outcomes equation shows the causal impacts of school-supplied inputs. Thus, an empirical implementation of the model, at both the household and the school level, will help identify policies that the Bangladesh government could pursue to promote schooling among rural children.

The estimation of household-level outcomes assumes that the distribution of public resources at the school and village level is given for household decisionmaking. The estimates may suffer from unobserved-variable bias due to unobserved parental or societal expectations that may influence schooling outcomes through their effects on the allocation of private and public resources to education. Thus, to estimate the school-level schooling outcomes, a grade-specific fixed-effects method is used that controls for the unobserved-variable bias arising from societal expectations about schooling.

6. Estimates of the household-level schooling performance

The household-level outcomes of interest here are the school participation, attainment, failure rate, and dropout rate of individuals. Table 3 gives the descriptive statistics of variables used in the school participation equation; the data cover 1,707 boys and 1,503 girls age 5 to 20.

About 64 percent of the boys and 57 percent of the girls had ever been in school. The mean age is 12 for both boys and girls. The mean length of their parents' schooling is also the same--three years for fathers and one year for mothers. More than 90 percent of the families of both boys and girls rely on a tubewell as their source of drinking water. The mean value of household assets is nearly 100,000 taka (Tk) for boys' families and Tk 96,000 for girls' families. About 59 percent of the members of boys' families and 45 percent of those of girls' families are male.

More than 26 percent of the children are reported to live in a village with a pucca road and 55 percent in villages with electricity. The mean share of total land of the villages that is irrigated is 45 percent. Sixty-nine percent live in a village with a primary school, and more than 25 percent of both boys and girls have a secondary school in their village. Among those who said they have a secondary

school in the village, about 16 percent of boys and 14 percent of girls reported having a girls-only secondary school, and about 81 percent of boys and 86 percent of girls reported having a coed secondary school. But among those reporting a secondary school in the village, about 23 percent of boys and 31 percent of girls said that it is a junior rather than a full-scale high school. And only 2 percent of boys and 1 percent of girls reported a postsecondary school in the village. The mean annual expenses (including tuition, books, and supplies) for students in grade 1 are Tk 424 for boys and Tk 427 for girls.

Equation 15 is estimated by the probit method in which S takes the value of 1 if the individual has ever been in school and zero otherwise. Separate probit regressions are reported for males and females age 5 to 20, and two probit regressions are estimated for the school participation decision of each gender: model 1, which does not include the grade 1 expenses, and model 2, which does include these expenses, among others, as an explanatory variable (table 4). Because school expenses are determined by some of the household characteristics, their inclusion in the regression may contaminate the coefficients of some household-level variables. The school expense data used here are from the village survey, however, and not from the school or household surveys, so the expense variable may be taken as exogenous to the household. Nevertheless, because the inclusion of the expense variable may change the sign or magnitude of community-level variables, the two school participation models were estimated. As table 4 shows, however, there is little difference between the results of the two models.

Irrespective of model specification, both father's and mother's education has an important influence on the school participation of both boys and girls. But mother's education has a greater effect than father's and interestingly, a greater effect for girls' school participation than for boys'. A one-year increase in father's education from the mean of three years increases boys' school participation by 3 percent and girls' by 4 percent. In contract, a one-year increase in mother's education from the average of one year increases boys' school participation by 11 percent and girls' by 17 percent. Thus, educating mothers has a much larger impact on the school participation of rural children, and in reducing the gender gap in Bangladesh.

Availability of roads has a positive effect on the school participation of both boys and girls, but the effect is much more significant for boys than for girls. Similarly, rural electrification has a much more important influence on boys' school participation than on girls'. In contrast, the positive effect of

irrigation is much more significant for girls than for boys.[16] Proximity to primary school is important for both boys and girls but is more important for girls than for boys. If the secondary school in a village is a junior rather than a high school, the school participation of girls is small. As expected, school expenses have a negative effect on the school participation of both boys and girls. After controlling for the effects of household- and community-level variables, school participation is higher in Khulna, Dhaka, and Chittagong regions than in Rajshahi region.

Once a child is in school, it is important to find out what school-level inputs are most important in determining the child's schooling attainment. Table 5 presents the descriptive statistics, and table 6 the regression results for the school performance (as measured by schooling attainment, failure, and dropout rates), of children age 5 to 20 given that the children are already in school. The schooling attainment, dropout, and failure rate outcomes are thus conditional regressions--conditional on the probability that children have attended school.

The means and standard deviations of all relevant variables of the schooling attainment, dropout, and failure rate regressions are shown in table 5. As table 5 suggests, among 1,320 boys and 1,007 girls age 5 to 20 who have ever been in school, the mean schooling attainment is 4.25 years for boys and 4.04 years for girls. The failure rate, calculated as the proportion of currently enrolled students who could not pass the last year's examination, is 11 percent for boys and 12 percent for girls. The dropout rate, defined as the proportion of children ever in school who are currently out of school, is 21 percent for boys and 27 percent for girls. The performance of girls in terms of schooling attainment and failure is as good as that of boys, but girls drop out more than boys do.

Table 6 presents the Cox estimates of schooling attainments. The Cox regression technique estimates the probability of failure at a particular grade, given that an individual has already been in that grade. This technique is preferred over an ordinary least squares method, because total years of schooling are not observed for children still in school. The failure rate is estimated with a probit

[16]The development of irrigation has both a substitution and an income effect. Irrigation increases the demand for labor and thus raises the opportunity cost of schooling if child labor is a substitute for hired labor in farming. Thus, irrigation development may increase the demand for child labor, especially male child labor as females do not work on farms. On the other hand, irrigation increases farm income and thus has an income effect that increases the demand for schooling for both male and female children, assuming that schooling is a normal good. This finding suggests that the positive income effect outweighs the negative substitution effect for girls, and cancels out the substitution effect for boys.

technique that estimates the likelihood of a currently enrolled student failing a particular grade. Similarly, the dropout rate is estimated with a probit regression for those who have ever been in school but are currently out of school. Each set of regressions is estimated separately for boys and girls.

The regression results show that both father's and mother's education has a positive effect on the schooling attainment of both boys and girls. But unlike its effects on school participation, mother's education plays a weaker role than father's education in girls' education attainment. Father's education reduces both the failure rate and the dropout rate of boys, and mother's education reduces girls' failure rate. Greater household assets are associated with greater schooling attainment for both boys and girls, but the effect is more important for girls than for boys. Greater household assets are also associated with lower dropout and failure rates for boys. As expected, a better source of drinking water (in this case the tubewell) increases children's schooling attainment, especially for male children. Tubewell water also reduces girls' dropout rate. A higher proportion of male family members increases girls' dropout rate, an indication of pure gender bias in the allocation of family resources.

Among the village-level variable, irrigation increases boy' failure rate and thus reduces their schooling attainment. This effect implies that irrigation increases the opportunity cost of boys' time in school (to the extent that boys are substitutes for hired labor), perhaps encouraging boys' participation in family farming and hence exerting a negative effect on their school performance.

The greater a school's distance from the thana headquarters is, the lower the schooling attainment of children, especially that of boys. Because the government supplies most inputs to schools and its agencies are located in thana headquarters, this effect may be a measure of the effectiveness (or supply) of supervision and other inputs from government agencies. Thus, the greater the distance of a school from the thana headquarters, the less effective the school supervision (or the smaller the supply of government inputs) is and, thus, the poorer the school performance of children is.

The longer a school has been in operation, the higher is the girls' dropout rate. It matters for boys whether a school is public or private: boys' failure and dropout rates are higher at government than at private schools. Also important for boys is whether a school has a supply of drinking (tubewell) water; a water supply in the school significantly reduces boys' failure and dropout rates and thus increases their schooling attainments.

School electrification, which reflects an area's infrastructural development, increases schooling attainment for girls. Also important for girls is the presence of female teachers: the higher the proportion of female teachers in a school, the lower the female dropout rate is. The schooling attainment of both boys and girls is higher if teachers have both college and education degrees, and girls' failure and dropout rates are lower if teachers have college degrees.

The higher the grade offered in a school, the higher the schooling attainment of both boys and girls is and the lower their dropout rates are. Few boys but more girls fail in the schools that offer a greater number of grades, however[17]. Although whether a school is coed has no effect on girls' school performance once they enroll, whether a school has separate toilet facilities for girls is important; separate facilities reduce girls' failure rate and thus increase their schooling attainment.

7. Estimates of school-level outcomes

The analysis of household-level data does not control for the effects of unobserved schooling expectations of parents or of society. Such expectations may influence children's schooling performance through their possible effects on the societal or private allocation of resources, which is not controlled for in the household-level regressions. The net impact of school-level public investments can, however, be analyzed by examining their effects on school-level outcomes, using a grade-specific fixed-effects method. This method controls for the unobserved effects of societal expectations on the education of boys and girls by grade.[18] The school survey data, augmented by village survey data, are used for estimation. Tables 8 and 9 show the distribution of resources to primary schools and schools secondary and above (henceforth, secondary schools) and the outcomes, such as grade-specific enrollment, failure, and dropout rates.

On average primary schools offer five years of schooling and secondary schools six years. An average primary school class has 33 male and 28 female students, and an average secondary school class

[17]This finding may imply gender differences in schooling expectations in the school or in the society. A grade-specific fixed-effects method is used to control for such unobserved expectations in the regressions for school-level outcomes discussed in the next section.

[18]Assuming that parental expectations do not differ from societal expectations, this fixed-effects method also takes care of the influence of unobserved parental expectations.

65 male and 36 female students. Although secondary school classes are, on average, larger than primary school classes, the student-teacher ratio in secondary schools (34) is much lower than that in primary schools (65).

About 84 percent of primary schools are government, but only 11 percent of secondary schools are. The student-teacher ratio is higher in government schools than in private schools. For example, the ratio in government primary schools is 69, compared with 49 in private primary schools.[19] Secondary school teachers are more likely to hold general and education diploma degrees--and thus to be more qualified-- than are primary school teachers. About 99 percent of primary and 78 percent of secondary schools are coed. Female teachers account for 20 percent of teachers employed at the primary level and 10 percent at the secondary level.

The allocation of resources between primary and secondary schools seems disproportionate. Only 6 percent of primary schools have electricity, compared with 52 percent of secondary schools. Only 12 percent of coed primary schools have separate toilet facilities for girls, compared with 78 percent of secondary schools. And while about 64 percent of primary schools have a drinking water supply, 97 percent of secondary schools do.

A crude proxy for the local demand for schooling is the proportion of irrigated land in the village where the school is located. In villages with a primary school about 41 percent of the land is irrigated compared with 34 percent of the land in villages with a secondary school.

The grade-specific fixed-effects estimates are shown in tables 8 and 9 for primary and secondary schools.[20] The school-level outcomes are aggregate measures of grade-specific enrollment, failure, and dropout rates. The results show that the greater the distance of a school from the thana headquarters, the lower the male grade-specific enrollment is at the secondary level and the higher the dropout and failure rates are for both boys and girls at the primary level. This finding supports the household-level finding that performance at a school varies depending on the distance of the school from its administrative

[19]If the student-teacher ratio reflects the quality of schooling, this may help explain the better performance of children in private school compared with children in government school.

[20]Estimates for coed primary and secondary schools only are shown in Appendix tables B.1 and B.2.

center. The results also show that the longer a school has been in operation, the higher the enrollment of boys and girls in both primary and secondary school, the lower the dropout and failure rates of both boys and girls at the secondary level, and the lower the dropout rate of girls at the primary level.[21]

The higher the grade offered in school--both primary and secondary-- the higher are the enrollment and dropout rates of both boys and girls. Higher teachers' degrees (college and education) are also associated with higher enrollment at both the primary and the secondary level. Teachers' education degrees reduce the failure and dropout rates of both boys and girls at the secondary level; thus education training for teachers improves secondary schools retention capacity. At the primary level a higher proportion of female teachers means more enrollment and less failure for both boys and girls. But at the secondary level the impact of female teachers is more pronounced for girls than for boys--increasing girls' enrollment and reducing their failure and dropout rates.

Government schools attract more students than private schools. Contrary to household-level findings, the failure and dropout rates of students (male and female) are lower in government than in private schools, at both the primary and the secondary level.[22] A school water supply increases primary school enrollment for both boys and girls but, surprisingly, increases the dropout and failure rates of secondary students. If a primary school is coed, enrollment is lower for both boys and girls, and the dropout rate is higher for girls. And if a secondary school is coed, more boys but fewer girls enroll, and the dropout rate is higher for girls and lower for boys.

If a primary or secondary school has electricity, an indicator of an area's infrastructural development, enrollment is higher for both boys and girls. Rural electrification also reduces students' failure and dropout rates, especially at the secondary level. Similarly, the development of irrigation in an area increases primary and secondary enrollment and reduces failure and dropout rates for both male and female students. The finding that irrigation is associated with lower failure rates for boys is in contrast with the finding at the household level reported earlier.[23]

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[21]The lower dropout rate for girls contrasts sharply with the household-level analysis where we find a higher dropout rate for girls. This is likely because we control for the unobserved expectations about schooling of boys and girls.

[22]This is surprising. It is not clear why the school-level and household-level regressions display different results.

[23]This is not surprising, given that irrigation indicates overall development in a village and this measures income rather than substitution effects (or income effects determines substitution effect).

8. Policy simulation

The results on schooling outcomes at both the household and the school level confirm that these outcomes are influenced by the accessibility and quality of schools, by household income and assets, and by community development. For policy purposes, it is desirable to know how policy changes that influence these factors would affect schooling outcomes. Based on the household-level estimates of school participation, attainment, failure, and dropout rates, policy simulations (assessing changes by changing one or several policy variables at a time) have been performed to suggest ways in which the government of Bangladesh could improve children's school performance, especially in rural areas.

The overall school participation rate calculated at the means of all relevant variables is 64 percent for boys and 58 percent for girls (table 10). Now, if the father's education is increased from the third to the fifth grade, the school participation rate increases to 72 percent for boys and 69 percent for girls, irrespective of model specification. In contrast, if the mother's education level is increased from the first to the fifth grade, the school participation rate increases to 78 percent for boys and 79 percent for girls, again irrespective of model specification. The gains are much larger for both boys and girls if the mother's rather than the father's education level is increased. The gains from investing in roads, electrification, and irrigation or from building more schools are modest, ranging from one to three percentage points for both boys and girls. The gains from subsidizing the costs to parents of sending their children to primary school (for books, other school supplies, and uniforms), are similarly modest: a subsidy of about 50 percent of the costs for a first-grade student increases the school participation rate of boys by 6 percent and that of girls by 3 percent. The effects of all such policy changes combined increase the school participation rate in rural Bangladesh to 92 percent for boys and 94 percent for girls.

Repeating the same simulation with the regressions for schooling attainment, failure rate, and dropout rate, which take into account more direct school supply variables, we find that the school quality variables have substantial impact on these outcomes. At the means of the variables used in the regressions, the schooling attainment is 4 years for both boys and girls, the failure rate is 11 percent for boys and 12 percent for girls, and the dropout rate is 21 percent for boys and 24 percent for girls (table 11). Increasing the mother's education level to grade 5 has a greater effect on the failure rate of both boys and girls than does raising the father's education level to grade 5: the increase in the mother's education reduces the failure rate from 11 to 8 percent for boys and from 12 to 7 percent for girls.

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Producing a water supply in each school reduces the male dropout rate by two percentage points, and providing electricity in each school reduces the female dropout rate by three percentage points, and providing electricity in each school reduces the female dropout rate by two percentage points. The sex of teachers and their education have a greater effect on schooling attainment than do parents' education and other school characteristics.

9. Conclusions

Bangladesh has less human capital, as measured by educational attainment and literacy, than other comparable low-income countries. The country's lower human capital levels can be explained in part by its low per capita income and its consequently small allocation of resources to education (only 2 percent of its GNP). But experience in such countries as Sri Lanka show that even in poor countries governments can promote private investment in schooling through public investments and other deliberate policies.

The government of Bangladesh, with the help of the World Bank and other development agencies has recently undertaken major educational reforms and investments designed to increase children's schooling attainment. These initiatives include the General Education Project (GEP) and the Female Secondary School Assistance Project (FSSAP).

Clearly, designing effective education policy requires an understanding of how different policy interventions affect schooling outcomes. The effects of government investments in schooling can be measured in two ways: at the household level, using indicators of school-supplied inputs along with household- and community-level variables, and at the school level, by assessing the school-level outcomes relative to school-level inputs supplied by the government and other sources given community demand for schooling. Both approaches may be subject to unobserved-variable bias due to endogeneity in program placement or interventions and to societal expectations about schooling. In measuring schooling outcomes at the household level this paper controls for various observed area characteristics. In estimating school-level outcomes it was a grade-specific fixed-effects technique that reduces the influence of unobserved grade-specific demand for education or supply of grade-specific school-level inputs.

A descriptive data analysis of schooling in rural Bangladesh shows that school performance is poor, especially among girls. Yet, although substantial gender differences exist at all levels of education,

the gender gap is less pronounced among the younger cohorts. Among individuals of all ages in rural Bangladesh, 58 percent of males ever enroll in school, compared with 41 percent of females. In contrast, among the younger cohort age 5 to 20, the school participation rate is 64 percent for boys and 57 percent for girls. Among those who enroll in primary school, 52 percent of males of all ages complete it, compared with 44 percent of females. In contrast, the primary school completion rate for the younger cohort is 39 percent for boys and 40 percent for girls. Among primary school graduates, 73 percent of males and 61 percent of females of all ages enter secondary school; in the younger cohort the transition rate from primary to secondary school is 84 percent for boys and 74 percent for girls. The dropout rate at the secondary level is much higher for girls than for boys, however. Among those in the younger cohort who enroll in secondary school, 29 percent of boys but only 18 percent of girls complete it. Thus, even though gender bias has declined, it remains high at the secondary level.

In summary, among those who enter primary school in rural Bangladesh, only 40 percent complete it, and only 7 percent (9 percent of boys and 5 percent of girls) manage to complete secondary school. About 40 percent of rural children never show up at school at all.

Factors specific to households play an important role in determining children's school performance. Both father's and mother's education increases the school participation and attainment of both boys and girls. But mother's education has a greater effect than father's on girls' school participation and attainment, and, thus, in reducing the gender gap. Greater household assets are associated with greater schooling attainment, although not with higher school participation rates. The effect on schooling attainment is stronger for girls than for boys, suggesting that, as income increases, the gender gap in schooling will diminish. Access to a better source of drinking water (in rural Bangladesh, tubewells), both in the school and in the household, increases the schooling attainment of both boys and girls. For girls, a higher proportion of male family members is associated with higher dropout rates, suggesting gender bias in the family preference structure.

The characteristics of school systems are also important determinants of schooling outcomes, and they lend themselves well to targeting by government interventions. Greater proximity to primary school, for example, increases children's school participation--more for girls than for boys. Thus, government efforts to reach rural children in remote areas (as the GEP seeks to do by developing satellite or informal schools) will promote school participation among both boys and girls and help reduce the gender gap in

schooling investments. Similarly, the higher the grade offered in a school, the lower the dropout rate and, thus, the higher the school attainment for both boys and girls. Increasing the number of grades offered in a school, where needed, will therefore improve schooling outcomes.

Teachers' education (both general and training) improves the schooling attainments of both boys and girls by reducing their failure and dropout rates. This suggests that the GEP's efforts to improve teachers' education in rural Bangladesh will have a significant effect on schooling attainment. Recruiting more female teachers, as proposed in both the GEP and the FSSAP, should also improve schooling attainments, especially for female students at the secondary level. Improved toilet facilities in schools, as proposed in the FSSAP would also contribute to higher schooling attainment for girls.

Investments in rural infrastructure, independent of interventions targeting schools, can also help promote schooling in Bangladesh. For example, constructing rural roads could be expected to increase children's school participation, though more for girls than for boys. Rural electrification has positive effects on the school performance of both boys and girls; it increases school participation for both, though more for boys, and raises schooling attainment, though for girls. Development of irrigation increases school participation more for girls than for boys, and, in the short run, it may reduce the schooling attainment of rural boys because of substitutability (although imperfect) of child (especially male child) labor with hired labor in farm production. In the long run, however, the (positive) income effect of irrigation may outweigh the (negative) substitution effect so that its development promotes investment in the schooling of farm children.

A policy simulation exercise shows that if the concern is increasing school participation, the single most important intervention is to educate mothers. Mother's education makes the largest contribution toward increasing children's education and in reducing the gender gap. To raise the school participation rate from the current 64 percent for boys and 58 percent for girls to 79 percent for both, mothers' average schooling attainment needs to be increased from the present one year to five years. Achieving this change will take time however. In the meantime, interventions should be undertaken that promote better schools (with more female teachers, better-trained and-educated teachers, and better water and sanitation facilities), rural electrification, and irrigation. These measures will increase both school participation and schooling attainments by reducing dropout and failure rates.

STATISTICAL ANNEX

(Tables and Figures)

Table 1
Major indicators of economic and social development of Bangladesh, 1990

Indicator	Bangladesh	Average for South Asian countries (excluding Sri Lanka)	Average for Sri Lanka	Average for low income countries
Per capita income (U.S. dollars)	210	349.7	470	360
Life expectancy at birth (years)	52	58.5	71	63
Population growth rate (percent)	2.3	2.2	1.4	2.0
Total fertility rate	4.6	4.2	2.4	3.8
Infant mortality rate (per thousand live births)	105	94	19	69
Adult literacy rate (percent)	35	46	88	60
Adult female literacy rate (percent)	22	32	83	48
Primary school enrollment (net)	63	1/m	100	68
Female as percentage of male primary (gross) enrollment	78	66	93	78
Secondary school (gross) enrollment	17	40	74	36
Female enrollment as percentage of male secondary (gross) enrollment	47	52[a]	105	64

Notes: The school enrollment figures are for 1989.
[a]Data for Nepal were not available.

Source: World Bank 1992.

Table 2
School performance profile by sex and age-group

	Males of all ages		Females of all ages		Males ages 5-20		Females ages 5-20	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	100	100	100	100	100	100	100	100
Entered primary school	58	58	41	41	64	64	57	57
Did not enter primary school	42	42	59	59	36	36	43	43
Completed primary school	30	52	18	44	25	39	23	40
Did not complete primary school	28	48	23	56	39	61	34	60
Entered secondary school	22	38	11	27	21	33	17	30
Did not enter secondary school	8	14	7	17	4	6	6	11
Completed secondary school	7	12	2	5	6	9	3	5
Did not complete secondary school	15	26	9	22	19	30	14	25

Note: Percentages are calculated based on those who ever enrolled in a primary school.

Source: Author's calculations.

Table 3
Means and standard deviations of variables in school participation data for children age 5 to 20

Variable	Obs.	All	Obs.	Boys	Obs.	Girls
Individual-level						
School participation	3,210	.61 .49	1,707	0.64 (0.48)	1,503	0.57 (0.50)
Age	3,210	11.72 (4.57)	1,707	11.68 (4.55)	1,503	11.77 (4.59)
Household-level						
Father's education	3,100	2.74 (3.56)	1,667	2.8 (3.6)	1,433	2.7 (3.6)
Mother's education	3,120	1.13 (2.26)	1,660	1.1 (2.25)	1,460	1.2 (2.28)
Total assets of household (thousands of taka)	3,210	97.92 (267.82)	1,707	99.90 (269.63)	1,503	95.67 (265.82)
Source of drinking water (1=tubewell, 0=others)	3,210	.90 (.30)	1,707	.90 (.30)	1,503	.91 (.29)
Proportion of male members	3,210	.53 (.15)	1,707	.59 (.13)	1,503	.45 (.14)
Community-level						
If village has pucca road (1=yes, 0=no)	3,210	0.27 (0.44)	1,707	0.26 (0.44)	1,503	0.27 (0.45)
Proportion of total land irrigated in the village	3,210	0.45 (0.31)	1,707	0.45 (0.31)	1,503	0.45 (0.31)
If village has electricity: (1=yes, 0=no)	3,210	.55 (.50)	1,707	0.55 (0.50)	1,503	0.55 (0.50)
If village has a primary school: (1=yes, 0=no)	3,210	.69 (.46)	1,707	0.69 (0.46)	1,503	0.69 (0.46)
If village has a secondary school: (1=yes, 0=no)	3,210	.26 (.44)	1,707	0.26 (0.44)	1,503	0.25 (0.44)
If village has a secondary school for girls only: (1=yes, 0=no)	3,210	.04 (.19)	439	0.16 (0.36)	383	0.14 (0.35)
If village has a coed secondary school: (1=yes, 0=no)	3,210	.21 (.41)	439	0.81 (0.39)	383	0.86 (0.35)
If village has a junior high school: (1=yes, 0=no)	3,210	.07 (.25)	439	0.23 (0.42)	383	0.31 (0.46)
If village has a postsecondary school: (1=yes, 0=no)	3,210	.02 (.13)	1,707	0.02 (0.13)	1,503	0.01 (0.12)

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Table 3 (continued)
Means and standard deviations of variables in school participation data for children age 5 to 20

Variable	Obs.	All	Obs.	Boys	Obs.	Girls
Total expenses for a student in grade 1 (taka)	3,210	425.67 (214.04)	1,707	424.21 (210.40)	1,503	427.31 (210.43)
Region 1 (Khulna)	3,210	.30 (.46)	1,707	.29 (.45)	1,503	.31 (.46)
Region 2 (Chittagong)	3,210	.11 (.31)	1,707	.11 (.32)	1,503	.10 (.30)
Region 3 (Dhaka)	3,210	.32 (.47)	1,707	.32 (.48)	1,503	.32 (.47)
Region 4 (Rajshahi)	3,210	.28 (.45)	1,707	.28 (.45)	1,503	.27 (.45)

Note: Figures in parentheses are standard deviations.

Source: Author's calculations.

Table 4
Probit estimates of determinants of school participation of children age 5 to 20

Variable	Boys		Girls	
	Model 1	Model 2	Model 1	Model 2
Individual-level				
Age (years)	.46	.46	.56	.56
	(10.08)	(10.10)	(10.68)	(10.77)
Age squared	-0.02	-0.02	-0.02	-0.02
	(-9.60)	(-9.64)	(-10.43)	(-10.53)
Household-level				
Father's education	.09	.09	.12	.12
	(6.74)	(6.73)	(8.29)	(8.29)
Mother's education	.11	.11	.17	.17
	(4.64)	(4.71)	(6.38)	(6.34)
Total assets of household	-0.19	-0.20	.25	.23
(thousands of taka)	(-1.32)	(-1.37)	(1.50)	(1.39)
Proportion of male members	.11	.13	-0.13	-0.13
	(0.43)	(0.50)	(-0.49)	(-0.49)
Source of drinking water:	-0.10	-0.12	.17	.17
(1=tubewell, 0=others)	(-0.82)	(-0.96)	(1.26)	(1.26)
Community-level				
If village has pucca road:	.13	.21	.05	.08
(1=yes, 0=no)	(1.45)	(2.18)	(0.47)	(0.85)
Proportion of total land irrigated	.10	.11	.31	.29
in the village	(0.72)	(0.74)	(2.01)	(1.89)
If village has electricity:	.14	.20	.06	.11
(1=yes, 0=no)	(1.78)	(2.54)	(0.75)	(1.22)
If village has any primary school:	.17	.18	.32	.35
(1=yes, 0=no)	(2.06)	(2.17)	(3.51)	(3.72)
If village has any secondary school:	.02	.04	-0.63	-0.62
(1=yes, 0=no)	(0.05)	(0.09)	(-1.33)	(-1.31)
If village has any secondary school	.25	.12	.66	.59
for girls only: (1=yes, 0=no)	(0.59)	(0.29)	(1.72)	(1.52)
If village has any coed secondary	0.10	0.04	.61	.57
school: (1=yes, 0=no)	(0.21)	(0.08)	(1.28)	(1.19)
If village has any junior high	-0.23	-0.18	-0.47	-0.43
school: (1=yes, 0=no)	(-1.18)	(-0.90)	(-2.44)	(-2.24)
If village has any postsecondary	-0.17	-0.05	.31	.40
school: (1=yes, 0=no)	(-0.32)	(-0.1)	(0.54)	(0.71)

Table 4 (continued)
Probit estimates of determinants of school participation of children age 5 to 20

	Boys		Girls	
Variable	Model 1	Model 2	Model 1	Model 2
Total expenses for a student in grade 1 (taka)	n.a.	-0.0006 (-2.98)	n.a.	-0.0004 (-1.93)
Region 1 (Khulna)	.33 (3.13)	.33 (3.16)	.23 (2.04)	.23 (1.98)
Region 2 (Chittagong)	.95 (6.37)	1.01 (6.69)	.67 (4.19)	.70 (4.37)
Region 3 (Dhaka)	.40 (3.94)	.41 (4.08)	.28 (2.47)	.30 (2.60)
Intercept	-3.10 (-9.20)	-2.94 (-8.60)	-4.05 (-11.34)	-3.95 (-10.94)
Number of observations	1,630	1,630	1,408	1,408
Log likelihood	-891.85	-887.40	-730.31	-728.44
Pseudo R-squared	0.16	0.17	0.24	0.24
Chi squared	345.51 [19]	354.42 [20]	458.02 [19]	461.75 [20]

Notes: Figures in parentheses are t-statistics. Figures in brackets are degrees of freedom.
n.a. = Not applicable.

Source: Author's calculations.

Table 5
Means and standard deviations of variables of school performance at the household level for children age 5 to 20

Variable	Obs.	Boys	Obs.	Girls
Individual-level				
Schooling attainment	1,320	4.25 (3.06)	1,007	4.04 (2.72)
Failure rate[a]	1,040	.11 (.31)	740	.12 (.33)
Dropout rate	1,320	.21 (.41)	1,007	.27 (.44)
Age (years)	1,320	12.29 (4.17)	1,007	12.52 (4.10)
Household-level				
Father's highest grade	1,294	3.64 (3.94)	967	3.87 (3.85)
Mother's highest grade	1,294	1.64 (2.63)	979	1.88 (2.71)
Total assets of household (thousands of taka)	1,320	109.22 (237.12)	1,007	121.13 (304.43)
Source of drinking water at home (1=tubewell, 0=others)	1,320	.89 (.31)	1,007	.91 (.29)
Proportion of male members	1,320	.60 (.13)	1,007	.45 (.13)
Community level				
Distance to nearest pucca road (kilometers)	1,320	2.40 (3.18)	1,007	2.53 (3.52)
Proportion of total land irrigated in the village	1,320	0.42 (0.33)	1,007	0.41 (0.32)
School-level				
Distance to thana Headquarters (kilometers)	1,320	8.37 (7.02)	1,007	8.61 (6.97)
How long the school has been in operation (years)	1,320	39.91 (25.69)	1,007	38.62 (25.89)
School type (1=govt., 0=others)	1,320	.63 (.48)	1,007	.61 (.49)
Water supply at school (1=yes, 0=no)	1,320	.81 (.40)	1,007	.78 (.41)

Table 5 (continued)
Means and standard deviations of variables of school performance at the household level for children age 5 to 20

Variable	Obs.	Boys	Obs.	Girls
School has electricity? (1=yes, 0=no)	1,320	.24 (.42)	1,007	.21 (.41)
Proportion of female teachers in school	1,320	.16 (.24)	1,007	.20 (.29)
Proportion of teachers with B.Ed/M.Ed degree	1,320	.12 (.21)	1,007	.13 (.23)
Proportion of teachers with bachelor's degree and above	1,320	.36 (.35)	1,007	.33 (.34)
Highest grade offered	1,320	6.90 (3.02)	1,007	6.46 (2.64)
If the school is coed (1=yes, 0=no)	1,320	.92 (.28)	1,007	.90 (.31)
Coed schools have separate toilets? (1=yes, 0=no)	1,208	.28 (.45)	902	.26 (.44)
Region 1 (Khulna)	1,320	.26 (.44)	1,007	.31 (.46)
Region 2 (Chittagong)	1,320	.15 (.36)	1,007	.12 (.33)
Region 3 (Dhaka)	1,320	.37 (.49)	1,007	.32 (.47)
Region 4 (Rajshahi)	1,320	.21 (.41)	1,007	.25 (.43)

Notes: Figures in parentheses are standard deviations.
[a/]Failure rate was based on only those currently attending school.

Source: Author's calculations.

Table 6
Determinants of school performance of children age 5 to 20

Variables	Cox estimates		Probit estimates			
	Attainment		Failure rate		Dropout rate	
	Male	Female	Male	Female	Male	Female
Individual-level						
Age (years)	0.58	0.65	-0.11	-0.29	0.44	1.05
	(11.85)	(10.69)	(-1.57)	(-3.15)	(3.4)	(3.75)
Age squared	-0.02	-0.02	0.01	0.02	-0.00	-0.02
	(-8.35)	(-7.73)	(4.87)	(5.63)	(-0.52)	(-2.11)
Household-level						
Father's highest grade	0.04	0.04	-0.05	0.02	-0.04	0.03
	(3.88)	(3.35)	(-2.90)	(1.02)	(-2.20)	(1.18)
Mother's highest grade	0.04	0.02	-0.03	-0.09	0.01	-0.02
	(2.57)	(1.26)	(-1.07)	(-3.20)	(0.47)	(-0.68)
Total assets of household (thousand of taka)	0.32	0.90	-1.52	0.07	-1.87	-0.36
	(2.14)	(4.21)	(-3.53)	(0.30)	(-3.49)	(-1.00)
Source of drinking water (1=tubewell, 0=others)	0.22	0.12	-0.04	-0.04	0.21	-0.67
	(2.21)	(0.99)	(-0.23)	(-0.18)	(1.04)	(-2.54)
Proportion of male members in household	-0.16	-0.03	-0.38	0.63	-0.33	1.56
	(-0.73)	(-0.13)	(-1.11)	(1.60)	(-0.76)	(2.60)
Community-level						
Distance to nearest pucca road (kilometers)	-0.00	-0.01	0.01	0.02	-0.01	-0.02
	(-0.49)	(-0.89)	(0.72)	(0.95)	(-0.35)	(-0.84)
Proportion of total land irrigated in the village	-0.22	0.09	0.30	-0.00	0.32	-0.10
	(-2.14)	(0.74)	(1.83)	(-0.00)	(1.57)	(-0.39)
School-level						
Distance to thana Headquarters (kilometers)	-0.01	-0.00	-0.01	-0.01	0.00	-0.01
	(-3.15)	(-0.44)	(-1.58)	(-1.59)	(0.40)	(-0.82)
How long the school has been in operation (years)	-0.00	0.00	0.00	0.00	0.00	0.01
	(-0.02)	(0.27)	(0.56)	(0.56)	(1.29)	(2.51)
School type (1=Govt., 0=others)	-0.12	0.10	0.32	0.04	0.50	0.18
	(-1.26)	(1.04)	(2.16)	(0.28)	(2.69)	(0.83)
Water supply (1=yes, 0=no)	0.11	0.03	-0.22	0.18	-0.58	0.12
	(1.38)	(0.31)	(-1.85)	(1.27)	(-3.86)	(0.60)

Table 6 (continued)
Determinants of school performance of children age 5 to 20

Variables	Cox Estimates		Probit Estimates			
	Attainment		Failure		Dropout	
	Male	Female	Male	Female	Male	Female
School has electricity? (1=yes, 0=no)	-0.03 (-0.28)	0.23 (1.75)	0.01 (0.07)	-0.20 (-0.98)	-0.06 (-0.30)	-0.33 (-1.24)
Proportion of female teachers in school	-0.07 (-0.45)	-0.09 (-0.64)	-0.24 (-1.01)	0.22 (1.01)	-0.10 (-0.34)	-0.55 (-1.75)
Proportion of teachers with B.Ed/M.Ed degree	0.46 (2.15)	0.45 (1.81)	0.50 (1.46)	0.33 (0.87)	0.01 (0.03)	-0.06 (-0.01)
Proportion of teachers with bachelors degree and above	0.67 (3.32)	1.07 (4.73)	-0.05 (-0.18)	-1.36 (-3.66)	0.12 (0.32)	-1.08 (-1.86)
Highest grade offered	0.17 (6.33)	0.10 (3.04)	-0.24 (-6.00)	0.08 (1.69)	-0.25 (-5.42)	-0.09 (-1.39)
School type (1=coed, 0=others)	0.18 (1.21)	-0.09 (-0.51)	-0.32 (-1.30)	0.30 (1.06)	-0.31 (-1.01)	0.14 (0.38)
Coed schools have separate toilets? (1=yes, 0=no)	-0.07 (-0.75)	0.18 (1.63)	0.14 (1.05)	-0.61 (-3.59)	0.22 (1.28)	-0.24 (-1.14)
Region 1 (Khulna)	-0.29 (-2.96)	-0.03 (-0.31)	0.16 (0.91)	-0.21 (-1.37)	-0.04 (-0.19)	0.63 (2.61)
Region 2 (Chittagong)	-0.05 (-0.41)	0.31 (2.49)	0.23 (1.64)	-0.12 (-0.63)	0.10 (0.42)	0.22 (0.83)
Region 3 (Dhaka)	-0.16 (-1.81)	0.04 (0.44)	0.31 (1.69)	0.33 (2.27)	0.01 (0.05)	0.66 (2.99)
Intercept	-	-	0.45 (0.69)	-1.12 (-1.47)	-4.28 (-4.09)	-11.17 (-5.10)
Pseudo R-squared	0.07	0.08	0.33	0.32	0.49	0.60
Log likelihood	-7438.28	-5250.62	-517.19	-403.50	-331.77	-204.80
Chi squared	1182.26 [23]	864.49 [23]	506.43 [23]	388.95 [23]	634.07 [23]	617.78 [23]
Number of observations	1,272	946	1,008	946	1,272	946

Notes: Figures in parentheses are t-statistics.
Figures in brackets are degrees of freedom.

Source: Author's calculations.

Table 7
Means and standard deviations of school-level variables

Variable	Observations	Primary	Observations	Secondary and above	Observations	All schools
Classwise students: Male	1,426	32.86 (24.17)	1,950	64.92 (82.79)	3,376	51.38 (66.75)
Classwise students: Female	1,425	27.89 (20.86)	2,006	36.43 (48.73)	3,431	(32.89) (39.83)
Grade-specific failure rate for males	1,347	.04 (.06)	1,747	.03 (.05)	3,094	.03 (.05)
Grade-specific failure rate for females	1,338	.04 (.07)	1709	.05 (.08)	3047	.05 (.08)
Grade-specific dropout rate for males	1,347	.19 (.18)	1,747	.12 (.13)	3,094	.15 (.16)
Grade-specific dropout rate for females	1,338	.21 (.19)	1,709	.17 (.18)	3,047	.19 (.19)
Proportion of teachers with B.Ed/M.Ed degree	296	.03 (.08)	383	.32 (.25)	679	.20 (.24)
Proportion of teachers with bachelor's degree and above	296	.14 (.19)	383	.81 (.16)	679	0.52 (0.37)
School type (1=govt., 0=others)	296	.84 (.37)	383	.11 (.31)	679	.43 (.50)
Proportion of female teachers in school	296	.20 (.26)	383	.10 (.19)	679	.15 (.23)
School type (1=coed, 0=others)	296	.99 (.10)	383	.78 (.41)	679	.87 (.33)
School has electricity? (1=yes, 0=no)	296	.06 (.25)	383	.52 (.50)	679	.32 (.47)
Coed schools have separate toilets? (1=yes, 0=no)	293	.12 (.32)	299	.78 (.41)	592	.44 (.50)
Student-teacher ratio	296	65.48 (25.48)	383	33.76 (11.50)	679	47.59 (24.59)
Government schools	248	69.15 (25.08)	41	36.29 (13.04)	289	64.48 (26.32)
Nongovernment schools	48	48.54 (18.20)	342	33.46 (11.29)	390	35.07 (13.05)

Table 7 (continued)
Means and standard deviations of school-level variables

Variable	Observations	Primary	Observations	Secondary and above	Observations	All schools
Water supply (1=yes, 0=no)	296	.64 (.48)	383	.97 (.17)	679	.83 (0.38)
Highest grade offered	296	4.94 (0.45)	383	10.46 (1.54)	679	8.04 (3.01)
Proportion of total land irrigated in the village where school is located	296	.41 (.32)	383	.34 (.32)	679	.38 (.32)
Number of classes per school	296	4.90 (.45)	383	6.02 (2.70)	679	5.53 (2.12)
Total teachers in all schools		1,334		5,976		7,310

Notes: Figures in parentheses are standard deviations.
Classwise data refer to one observation for each class in all schools, but schoolwise data refer to one observation for each school. Of the 383 secondary schools, only 15 (about 4 percent) are junior high schools (grades 6 to 8).

Source: Author's calculations.

Table 8
Fixed-effects estimates of determinants of school-level outcomes for all primary schools

Variable	Enrollment rate		Failure rate		Dropout rate	
	Male	Female	Male	Female	Male	Female
Distance from thana Headquarters (kilometers)	-0.04	-0.04	0.01	0.00	0.00	0.01
	(-0.41)	(-0.43)	(4.78)	(4.82)	(5.01)	(5.79)
How long the school has been in operation (years)	0.07	0.08	0.00	-0.00	-0.00	-0.00
	(2.47)	(3.44)	(0.04)	(-0.91)	(-0.75)	(-2.47)
Highest grade offered	9.00	6.27	-0.00	-0.00	0.05	0.09
	(4.30)	(3.46)	(-0.27)	(-0.21)	(2.13)	(3.22)
Proportion of teachers with bachelor's degree and above	9.72	11.44	0.00	-0.00	-0.03	-0.02
	(2.57)	(3.60)	(0.07)	(-0.17)	(-1.02)	(-0.52)
Proportion of female teachers in school	10.04	11.89	-0.02	-0.01	-0.02	-0.01
	(3.56)	(4.96)	(-1.95)	(-1.45)	(-1.09)	(-0.55)
School type (1=govt., 0=others)	6.46	6.58	-0.01	-0.01	-0.03	-0.04
	(2.90)	(3.51)	(-2.00)	(-0.78)	(-2.00)	(-1.99)
School has electricity? (1=yes, 0=no)	9.62	6.71	-0.00	-0.00	-0.07	-0.05
	(3.32)	(2.75)	(-0.22)	(-0.12)	(-3.12)	(-2.07)
Water supply (1=yes, 0=no)	3.63	4.57	0.00	0.00	-0.01	-0.01
	(2.59)	(3.88)	(0.30)	(1.03)	(-1.23)	(-0.98)
Proportion of total land irrigated in the village	5.18	5.62	-0.00	-0.01	-0.00	-0.03
	(2.57)	(3.30)	(-0.86)	(-1.78)	(-0.13)	(-1.55)
School type (1=coed, 0=others)	-36.31	-56.42	0.01	0.02	0.02	0.14
	(-3.67)	(-6.34)	(0.20)	(0.61)	(0.24)	(1.64)
Adjusted R-squared	0.10	0.15	0.03	0.02	0.04	0.05
F-statistics	10.33	15.44	3.21	2.48	4.38	4.91
Number of observations	1,281	1,280	1,212	1,203	1,212	1,203

Note: Figures in parentheses are t-statistics.

Source: Author's calculations.

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Table 9
Fixed-effects estimates of determinants of school-level outcomes for all secondary schools

Variable	Enrollment rate		Failure rate		Dropout rate	
	Male	Female	Male	Female	Male	Female
Distance from thana headquarters (kilometers)	-0.62 (-2.33)	0.23 (1.48)	-0.00 (-1.23)	-0.00 (-1.30)	-0.00 (-1.54)	0.00 (0.65)
How long in operation (years)	0.47 (6.16)	0.16 (3.30)	-0.00 (-1.77)	-0.00 (-3.19)	0.00 (0.62)	0.00 (0.35)
Highest grade offered	7.03 (5.64)	3.38 (4.28)	0.00 (0.42)	-0.00 (-0.73)	0.01 (2.66)	0.01 (1.09)
Proportion of teachers with B.Ed/M.Ed degree	-9.21 (-1.03)	3.12 (0.66)	-0.01 (-1.53)	-0.01 (-1.16)	-0.00 (-0.05)	0.00 (0.15)
Proportion of teachers with bachelor's degree and above	55.70 (4.25)	25.22 (3.44)	-0.02 (-2.21)	-0.02 (-1.39)	-0.16 (-6.42)	-0.19 (-5.37)
Proportion of female teachers in school	11.56 (0.83)	28.60 (4.26)	-0.00 (-0.27)	-0.05 (-3.55)	0.03 (1.15)	-0.05 (-1.53)
School type (1=govt., 0=others)	98.82 (14.18)	43.11 (11.24)	-0.01 (-1.54)	-0.02 (-1.50)	-0.04 (-2.42)	-0.06 (-2.24)
School has electricity? (1=yes, 0=no)	20.04 (5.24)	3.50 (1.59)	-0.01 (-3.47)	-0.01 (-2.61)	-0.02 (-2.47)	-0.04 (-4.01)
Water supply (1=yes, 0=no)	5.19 (0.61)	0.31 (0.06)	0.01 (2.11)	0.02 (2.05)	0.04 (2.83)	0.01 (0.48)
Proportion of total land irrigated in the village where school is located	5.97 (1.16)	5.48 (1.89)	-0.00 (-0.51)	-0.01 (-2.42)	-0.02 (-2.36)	-0.03 (-1.99)
School type (1=coed, 0=others)	19.43 (3.40)	-41.08 (-11.38)	-0.00 (-0.37)	-0.00 (-0.18)	-0.04 (-3.56)	0.02 (1.35)
Adjusted R-squared	0.29	0.34	0.03	0.04	0.07	0.07
F-statistics	32.02	44.09	3.00	4.20	5.87	6.29
Number of observations	1,950	2,006	1,747	1,709	1,747	1,709

Note: Figures in parentheses are t-statistics.

Source: Author's calculations.

Table 10
School participation with changes in selected policy variables of children age 5 to 20

	Boys		Girls	
	Model 1	Model 2	Model 1	Model 2
At means of all variables	0.64	0.64	0.58	0.58
Father's highest grade = 5	0.72	0.72	0.69	0.69
Mother's highest grade = 5	0.78	0.78	0.79	0.79
All villages have a pucca road	0.67	0.69	0.59	0.59
All villages have 70 percent of land irrigated	0.65	0.65	0.60	0.60
All villages have electricity	0.66	0.67	0.58	0.59
All villages have primary schools	0.66	0.66	0.61	0.61
All secondary schools are for girls	0.66	0.65	0.61	0.61
Total expense for grade 1 student = 200 taka	n.a.	0.68	n.a.	0.60
Changes in all variables	0.89	0.92	0.93	0.94

Notes: Simulation is done based on the results that are statistically significant.
n.a. = Not applicable.

Source: Author's calculations.

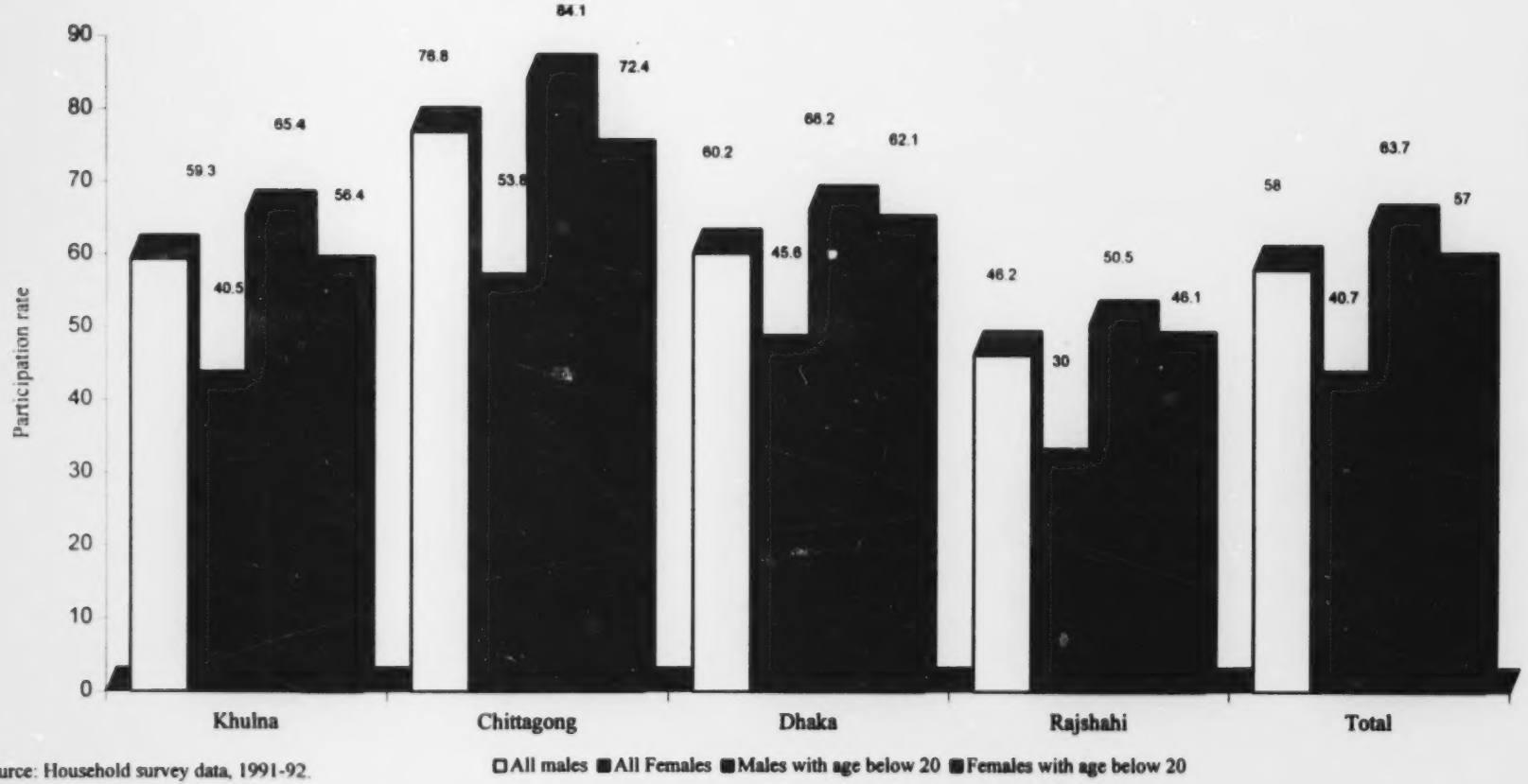
Table 11
Schooling performance of children age 5 to 20, with selected policy variables

	Attainment		Failure rate		Dropout rate	
	Male	Female	Male	Female	Male	Female
At means of all variables	4.24	4.02	0.109	0.122	0.206	0.235
Father's highest grade = 5	4.37	4.12	0.098	-	0.196	-
Mother's highest grade = 5	4.49	4.20	0.079	0.067	-	-
All drinking water sources are tubewells	4.29	4.04	0.105	-	-	0.225
60 percent of teachers are female	-	-	0.085	-	0.199	0.207
100 percent of teachers have education training	5.89	4.58	-	-	-	0.233
100 percent of teachers have BS degree or more	4.88	5.18	0.080	0.039	-	0.161
Water supply in all schools	4.29	-	-	-	0.188	
Electricity in all schools	4.38	4.45	-	0.109	0.202	0.208
Highest grade offered at all schools = 10	5.25	4.71	0.057	-	0.131	0.204
All coed schools have separate toilets for boys and girls	-	4.25	-	0.051	0.228	0.221
Changes in all variables	7.97	7.33	0.103	0.092	0.138	0.086

Note: Simulation is based on results that are statistically significant.

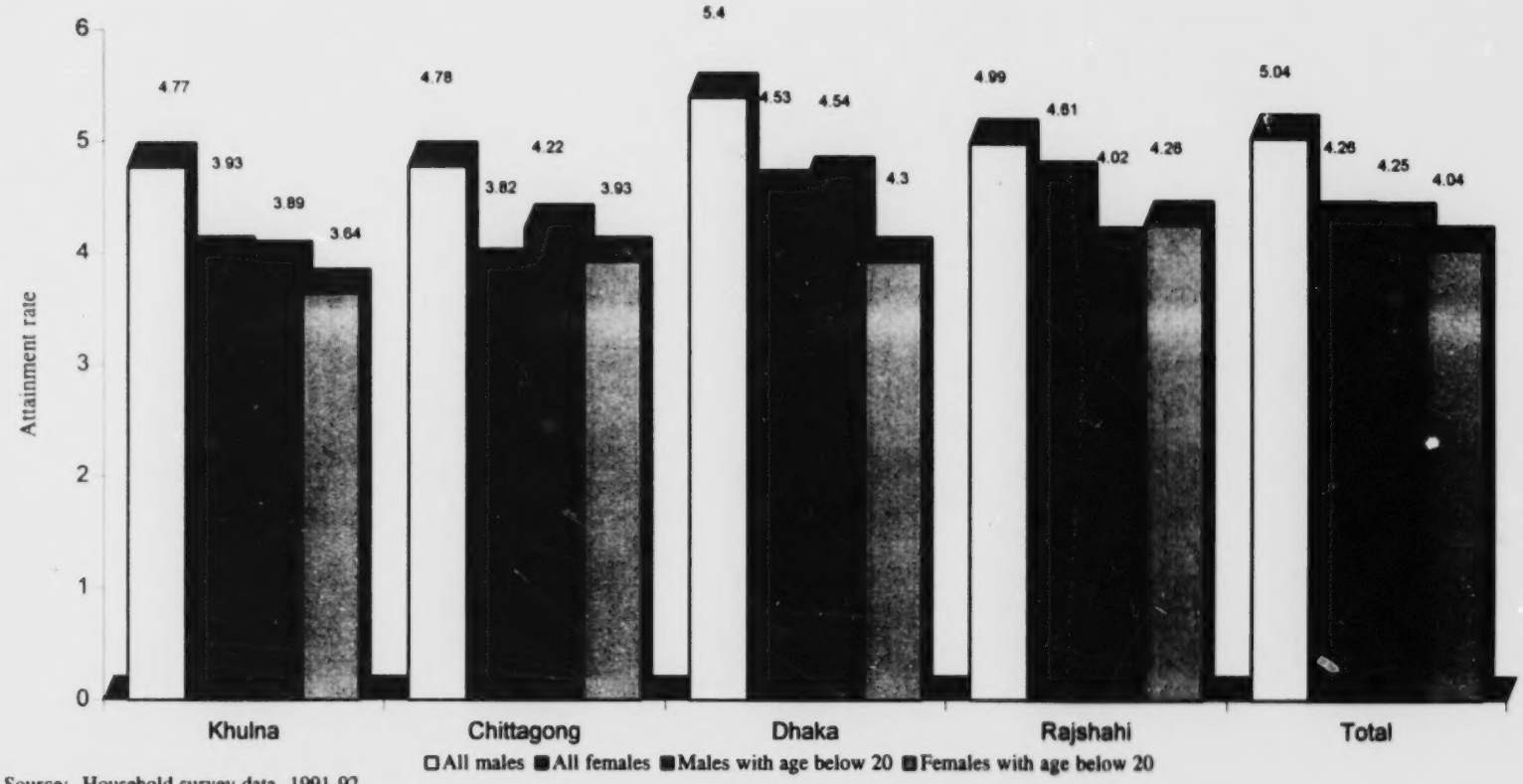
Source: Author's calculations.

Figure 1: School Participation by Region and Gender



Source: Household survey data, 1991-92.

Figure 2: Class Attainment by Region and Gender



Source: Household survey data, 1991-92.

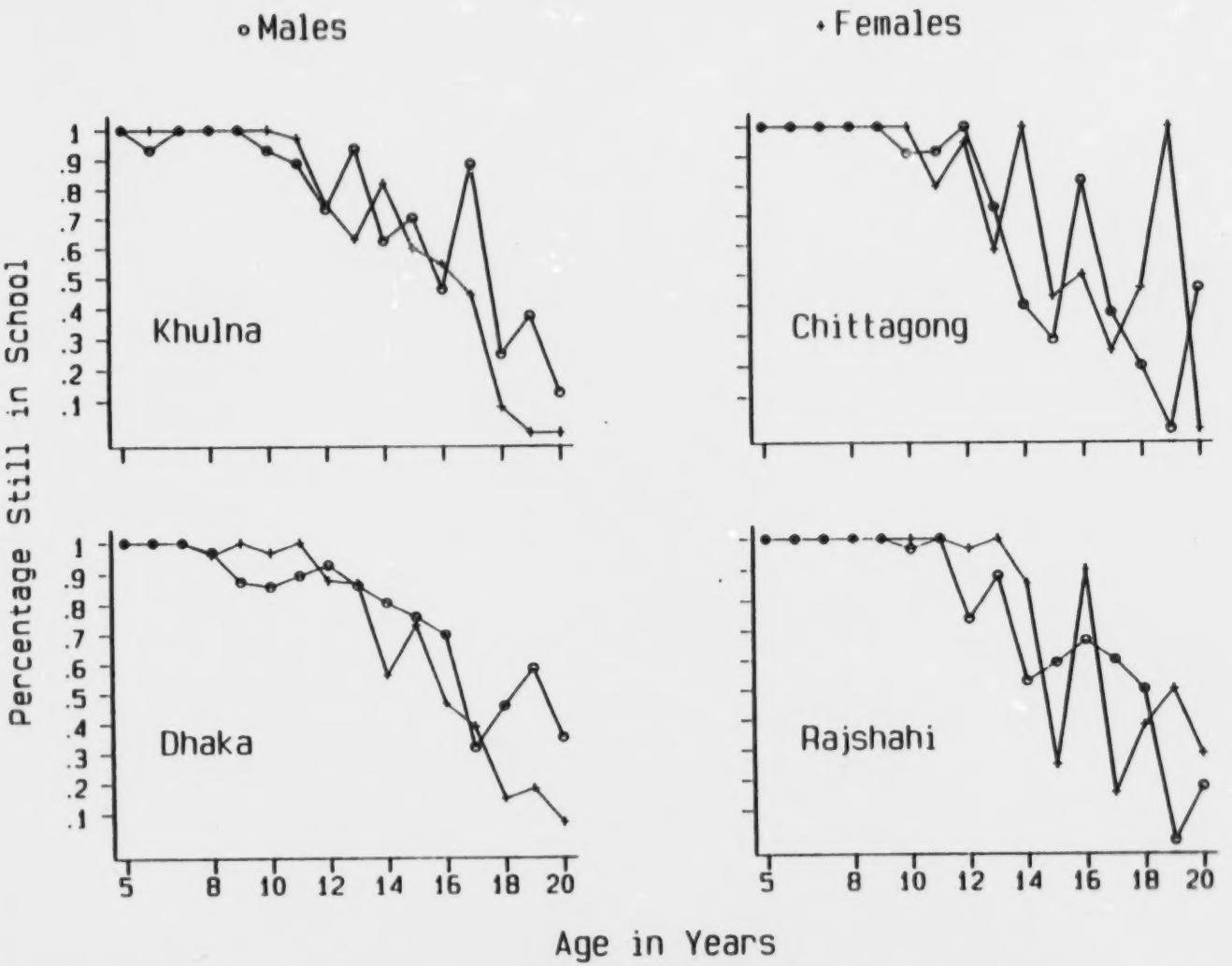


Figure 3 : Percent in School by Age

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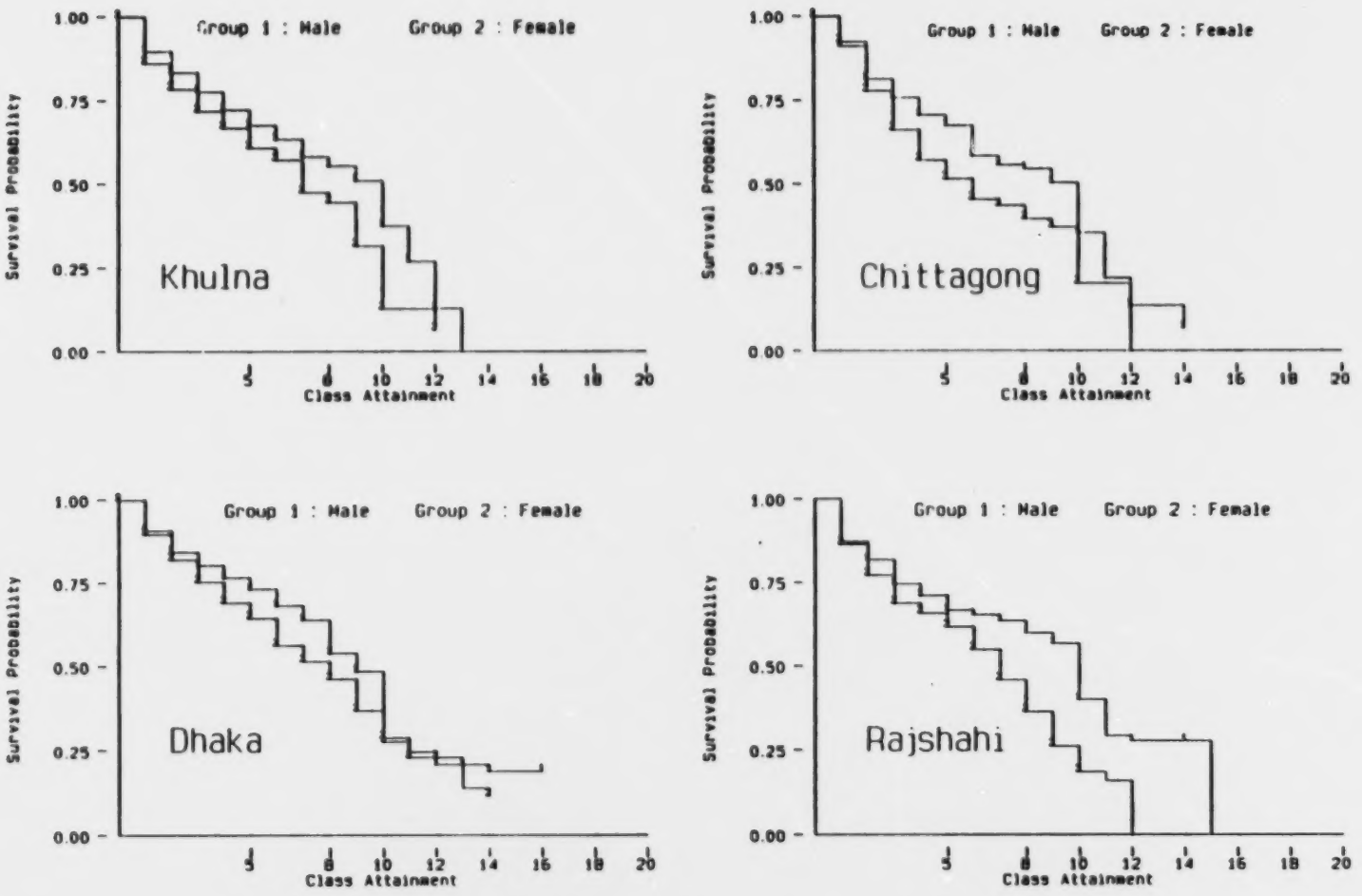


Figure 4 :

Kaplan-Meier Survival Curve:Attainments by Regions

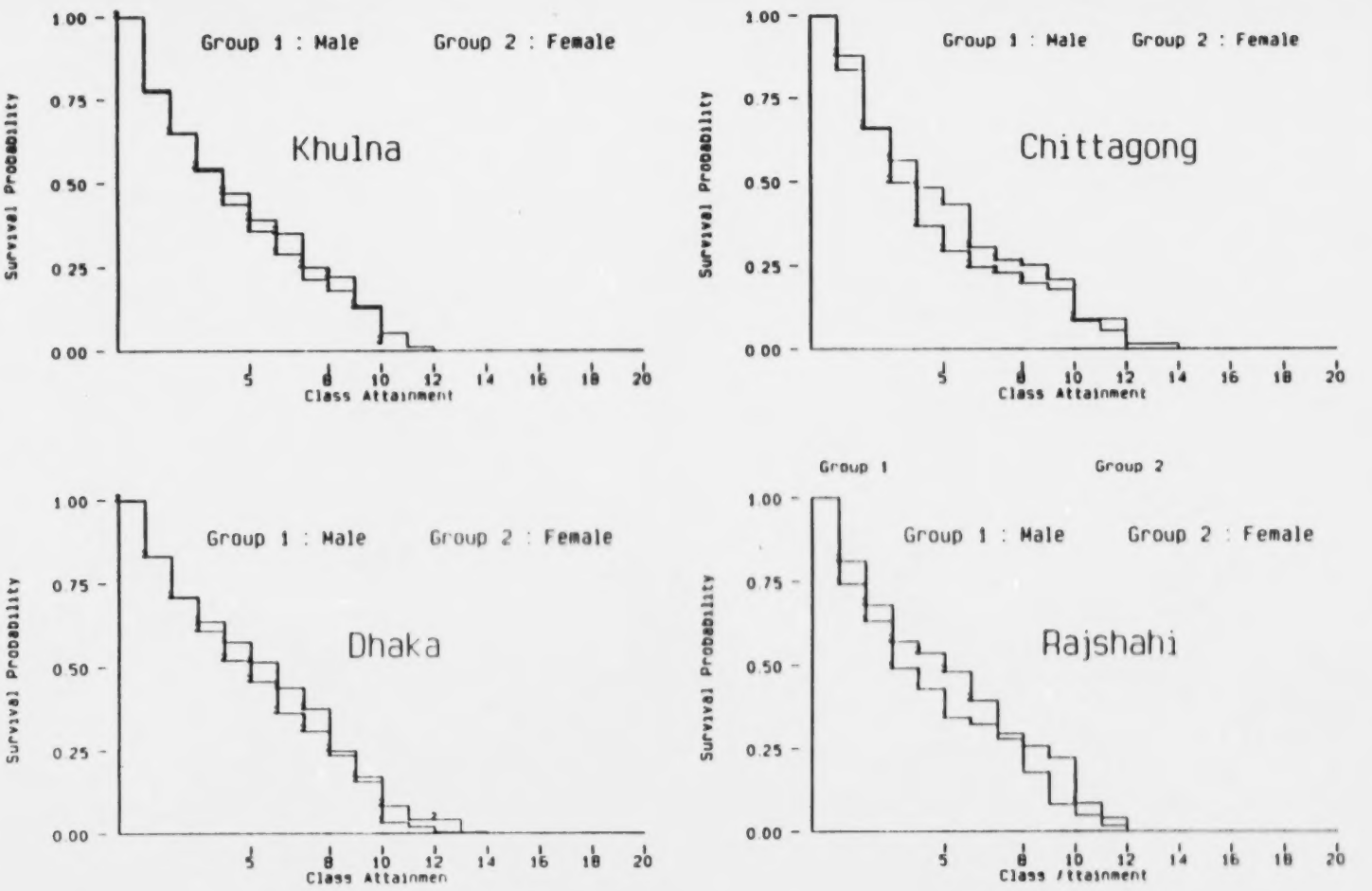
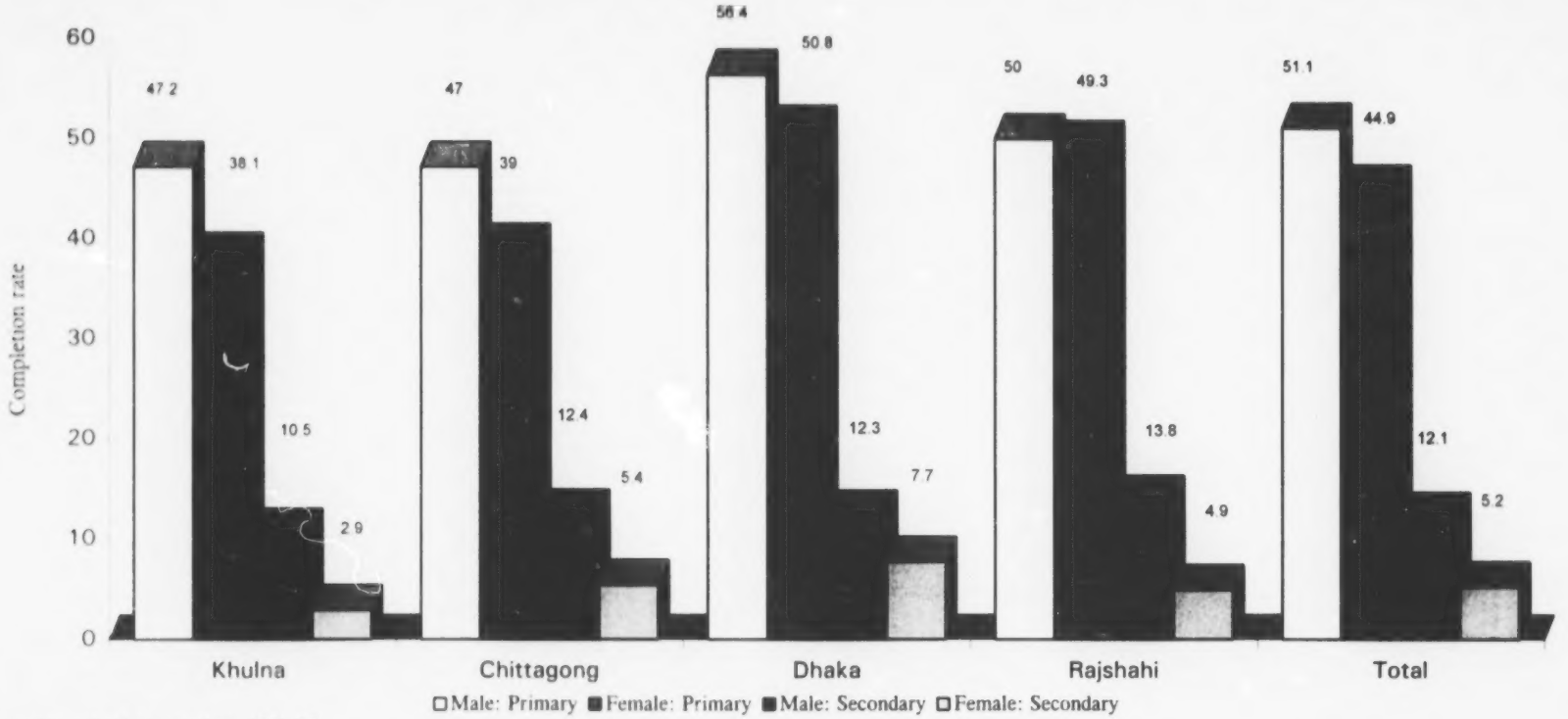


Figure 5 :

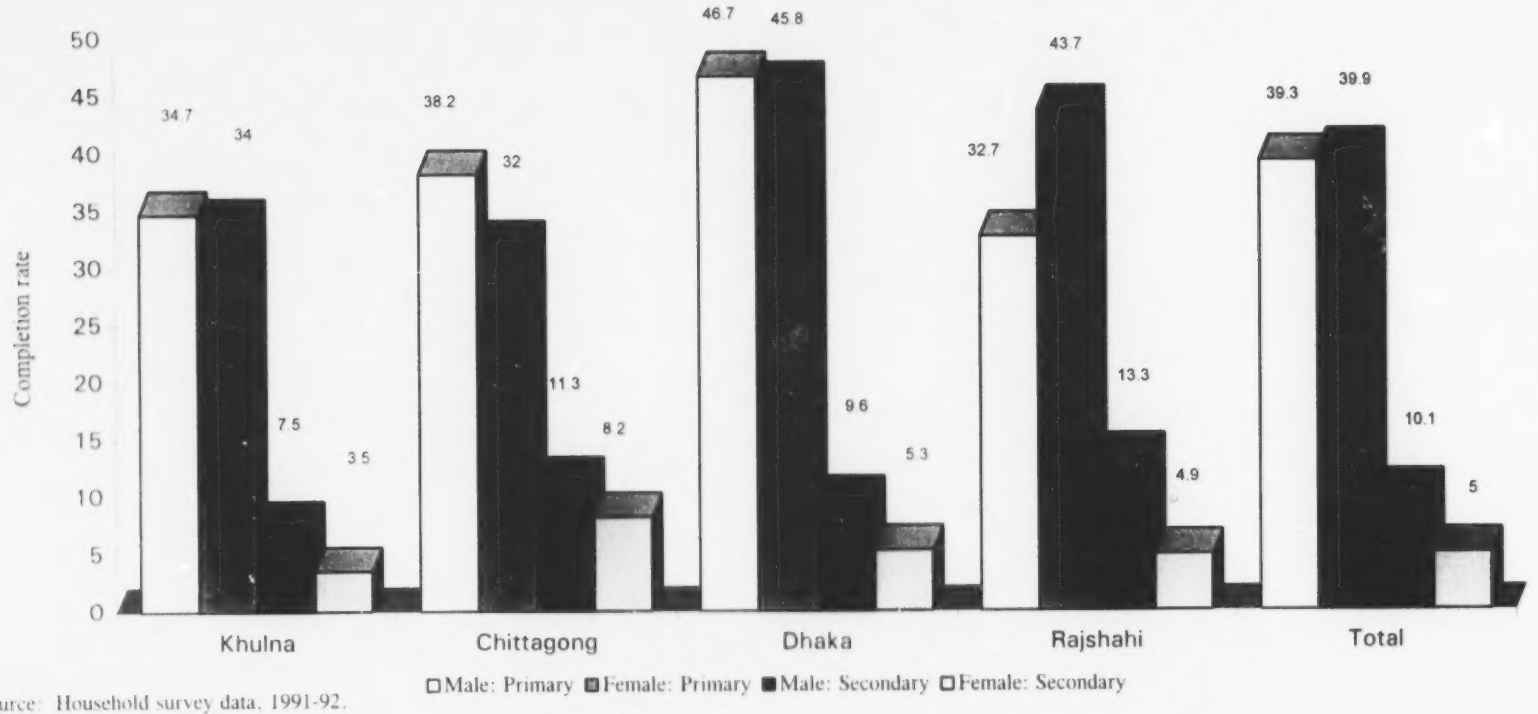
Kaplan-Meier Survival Curves by Regions (Age<=20)

Figure 6: School Completion by Region and Gender (For All Ages)



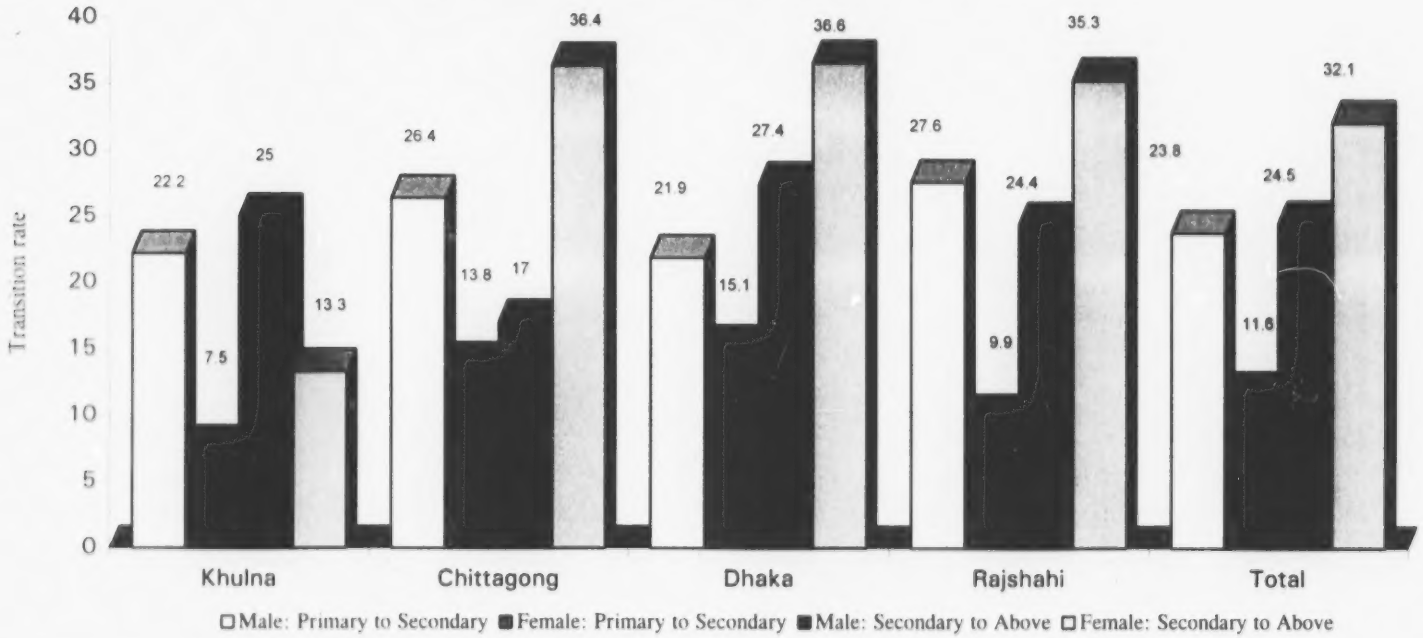
Source: Household survey data, 1991-92.

Figure 7: School Completion by Region and Gender (Age < = 20)



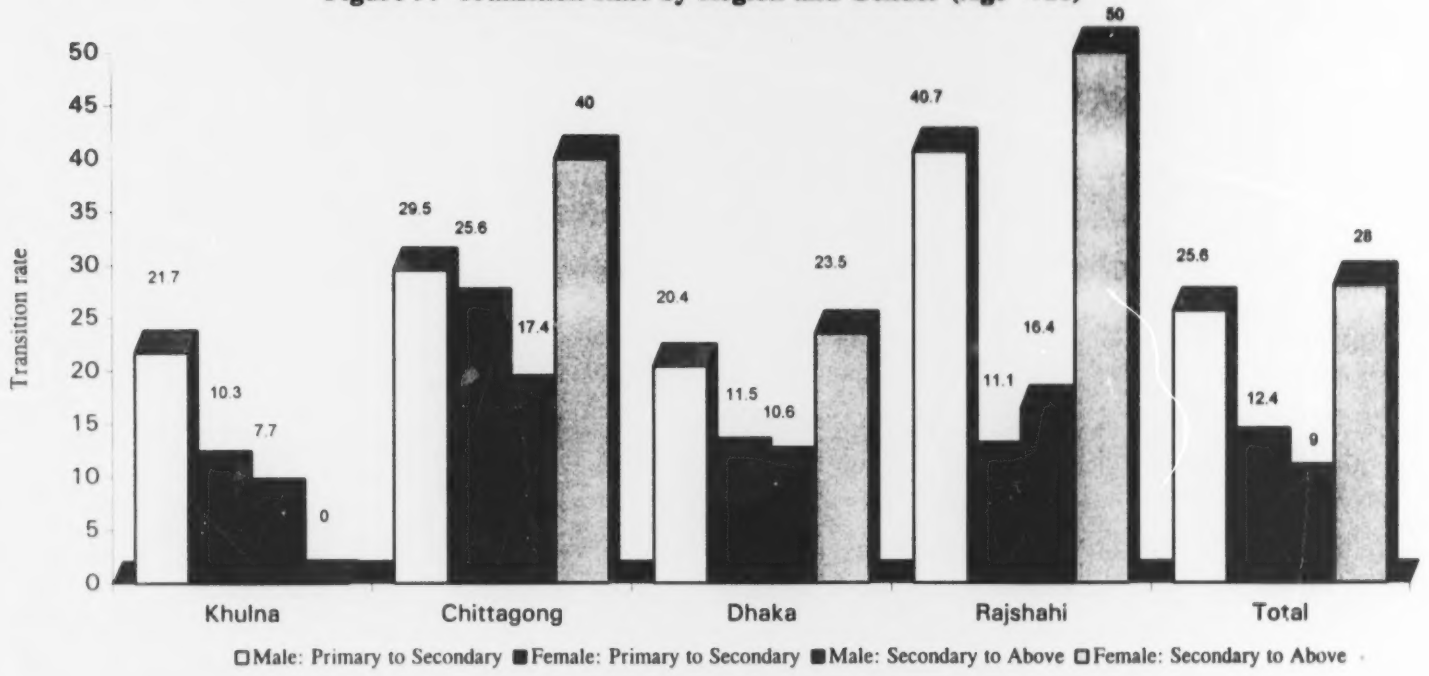
Source: Household survey data, 1991-92.

Figure 8: Transition Rate by Region and Gender



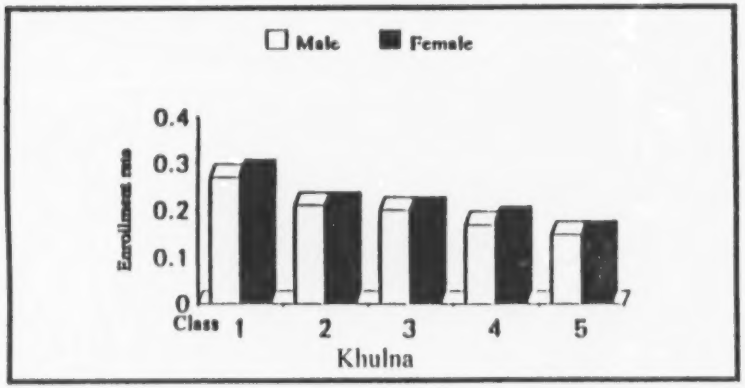
Source: Household survey data, 1991-92.

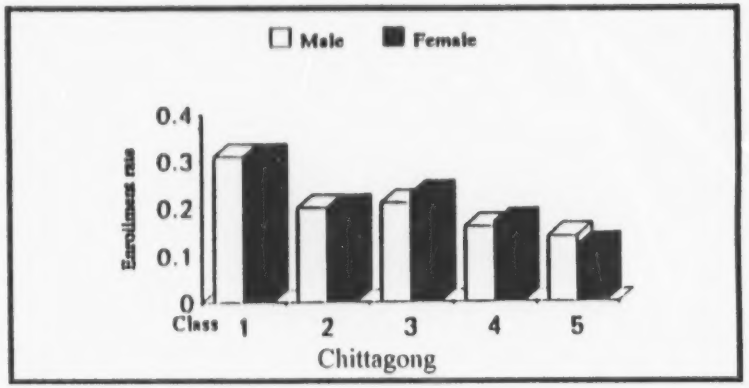
Figure 9: Transition Rate by Region and Gender (Age <20)

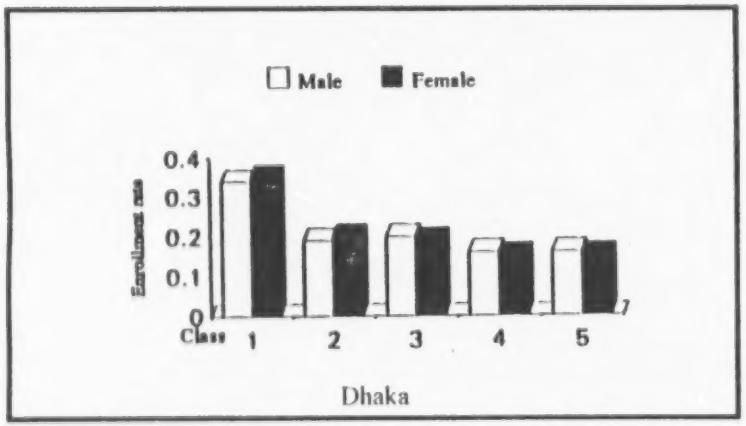


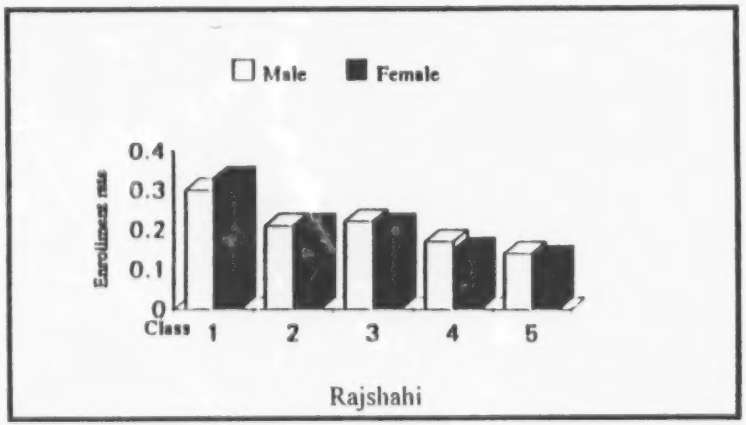
Source: Household survey data, 1991-92.

Figure 10: Primary Enrollment Rate by Region and Gender, 1992



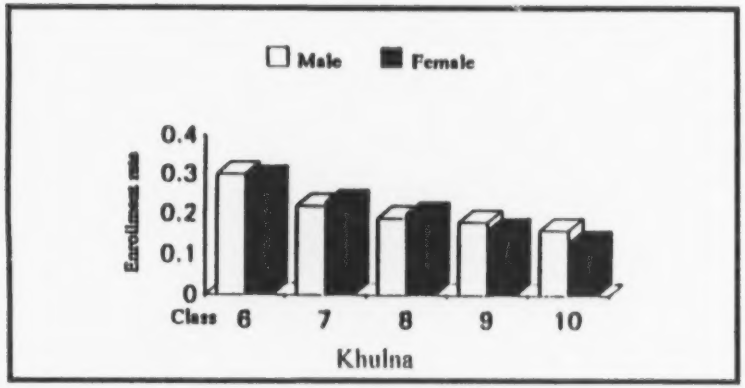


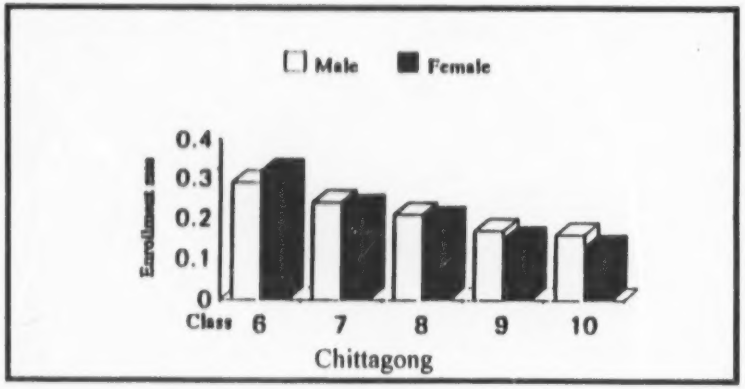


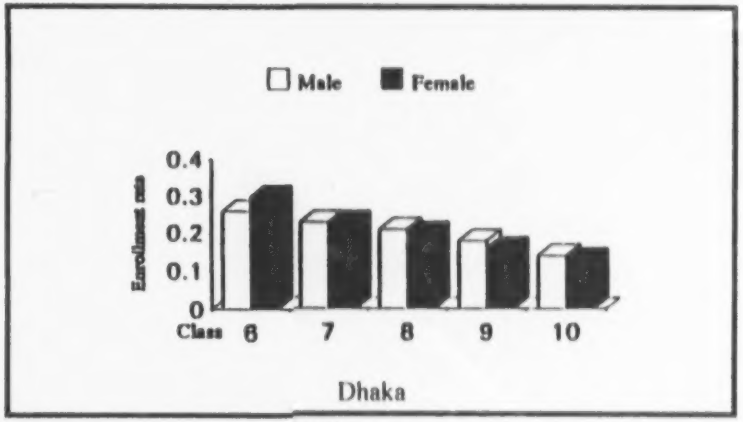


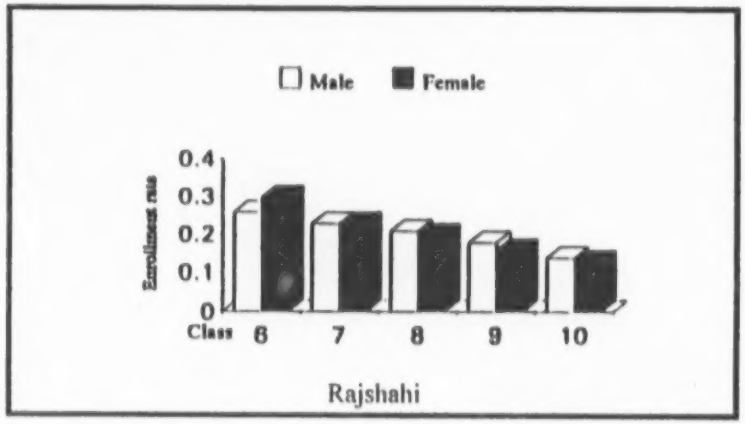
Source: School survey data, 1991-92.

Figure 11: Secondary Enrollment Rate by Region and Gender



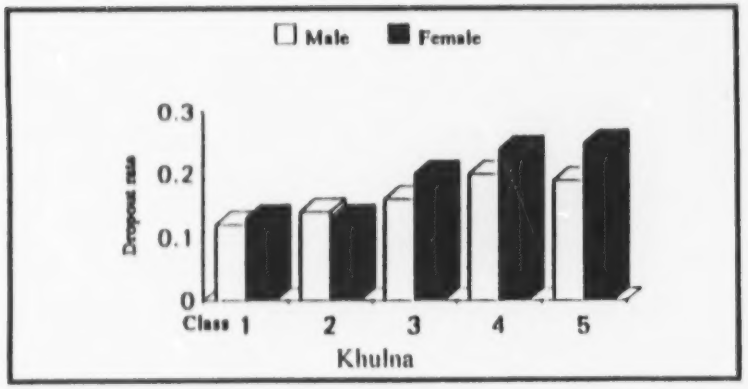


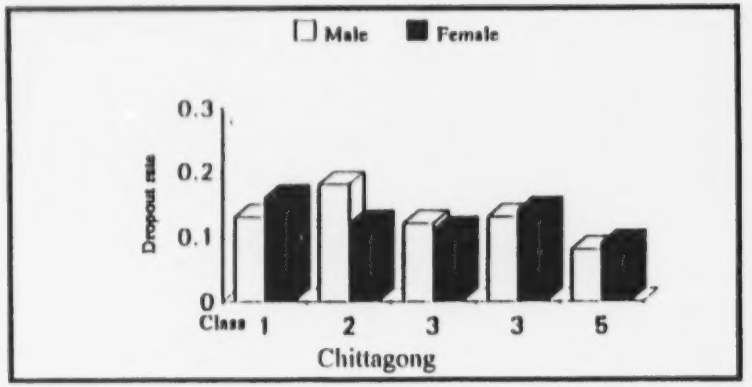


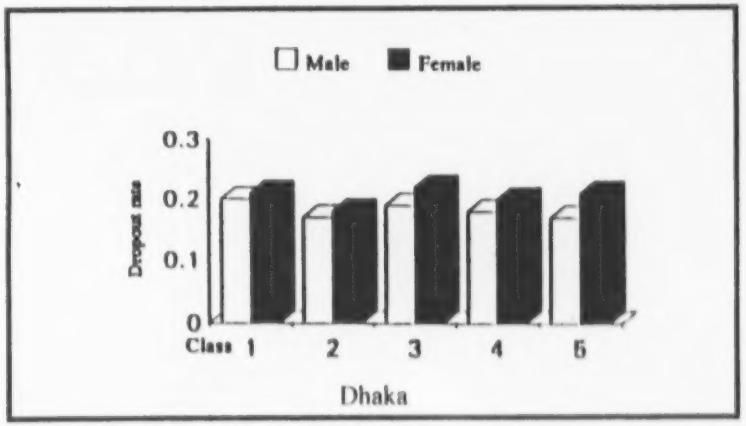


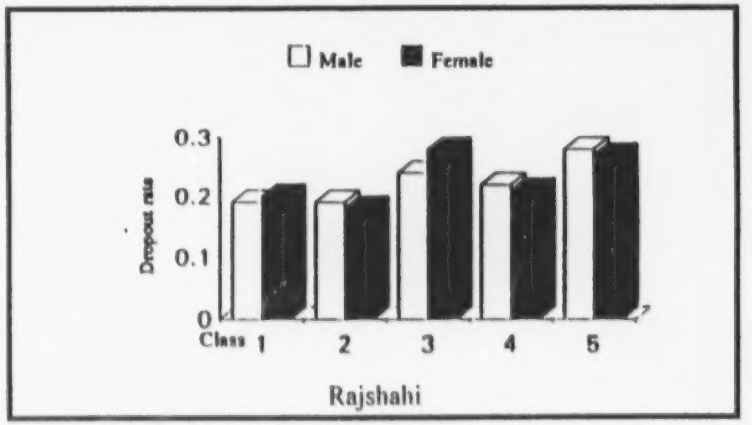
Source: School survey data, 1991-92.

Figure 12: Primary Dropout Rate by Region and Gender



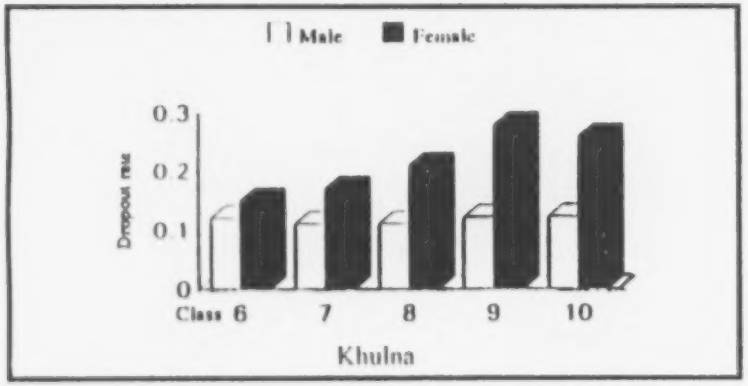


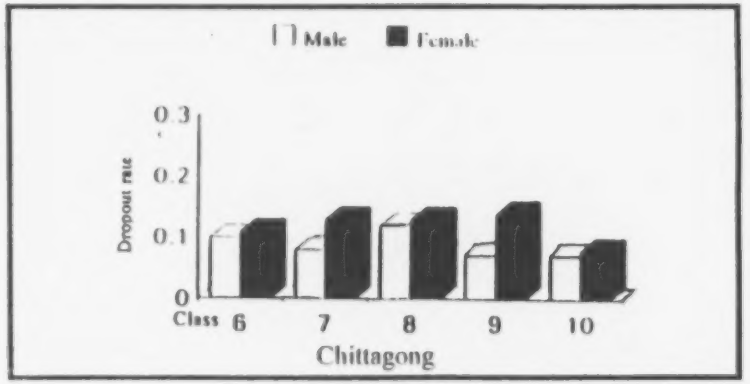


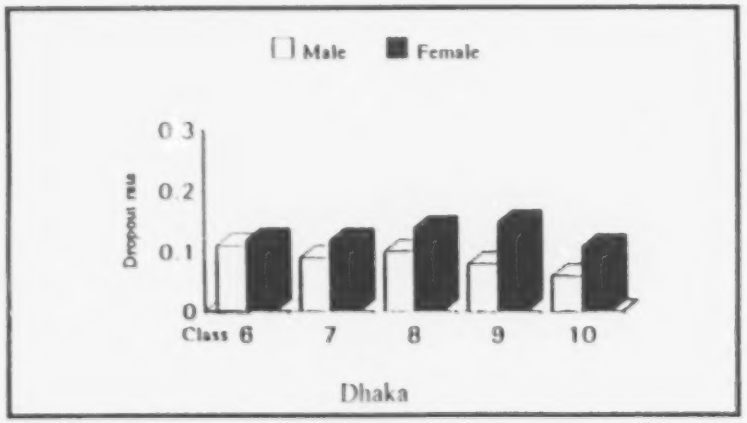


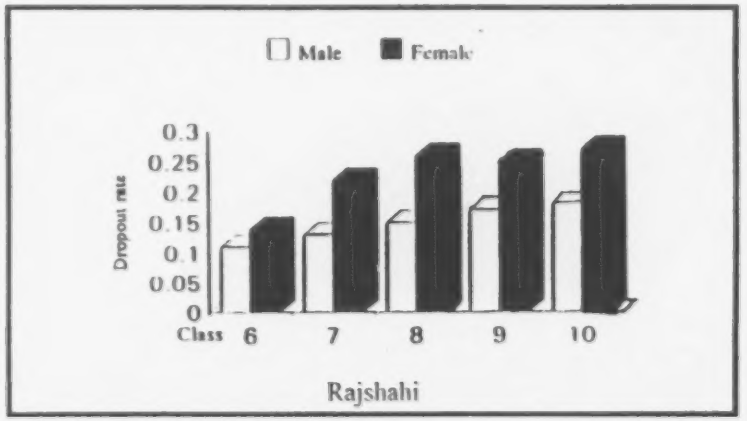
Source: School survey data, 1991-92.

Figure 13: Secondary Dropout Rate by Region and Gender



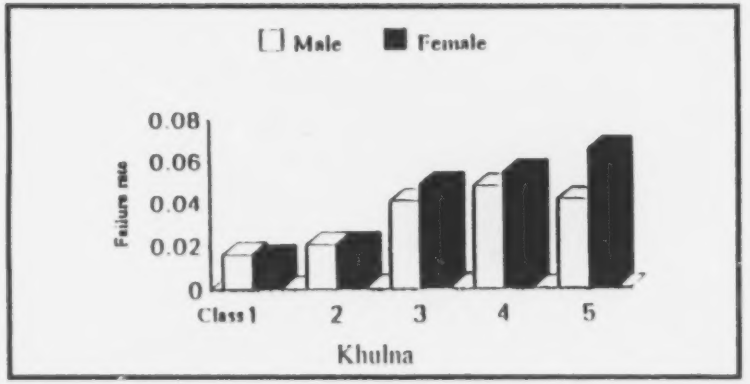


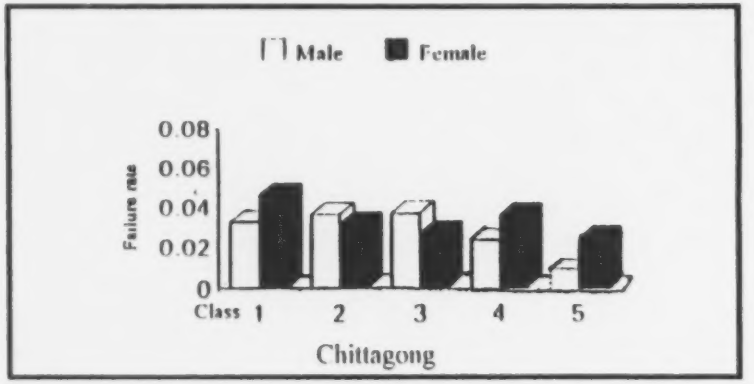


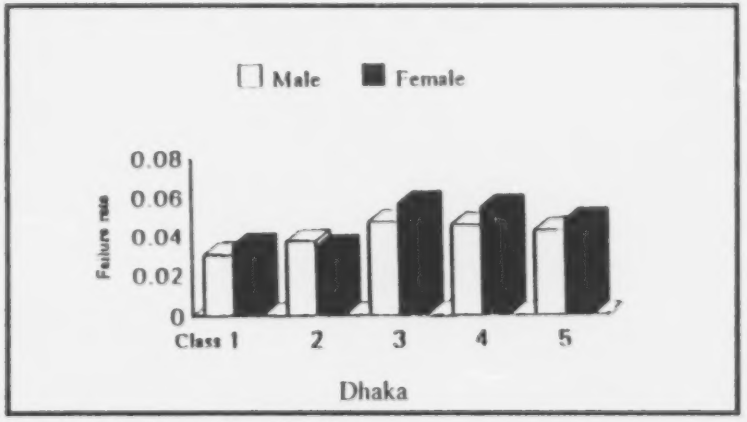


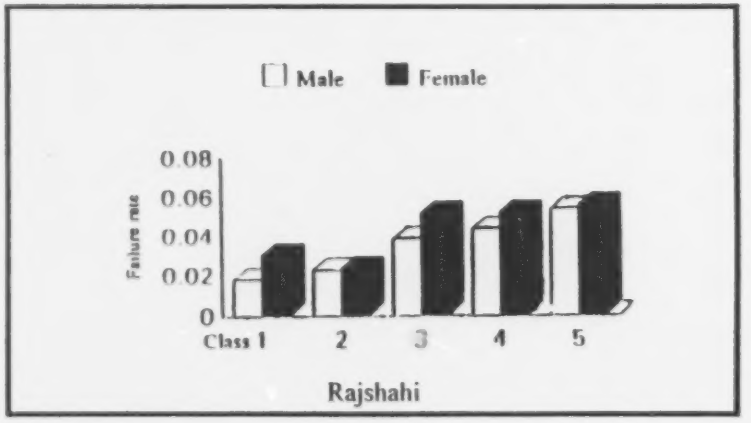
Source: School survey data, 1991-92.

Figure 14: Primary Failure Rate by Region and Gender



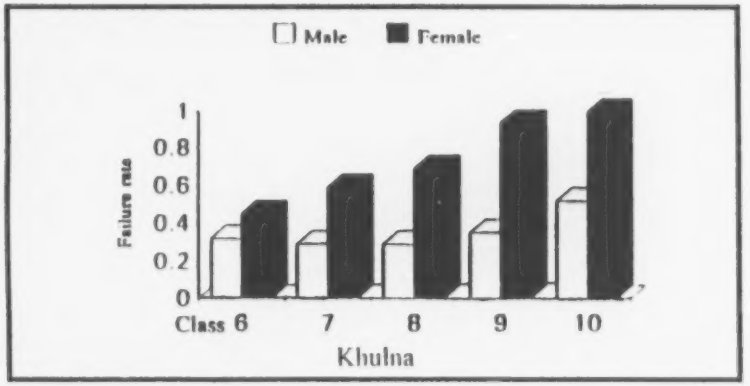


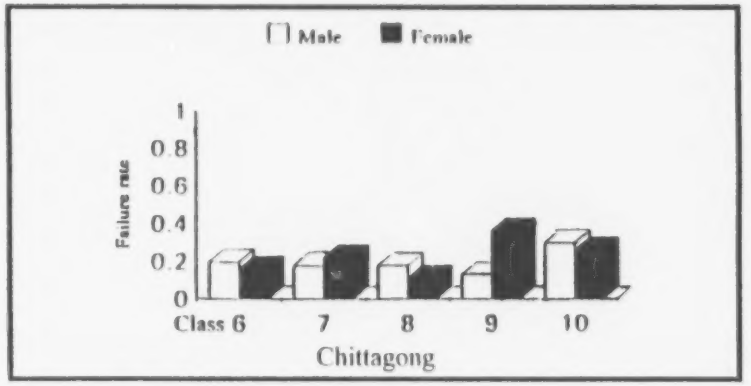


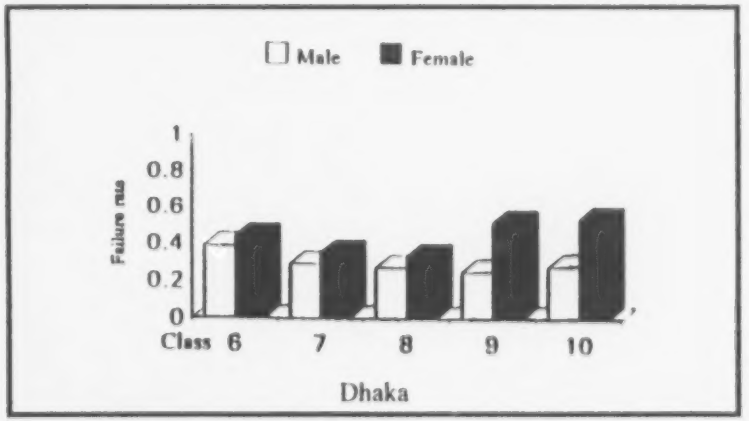


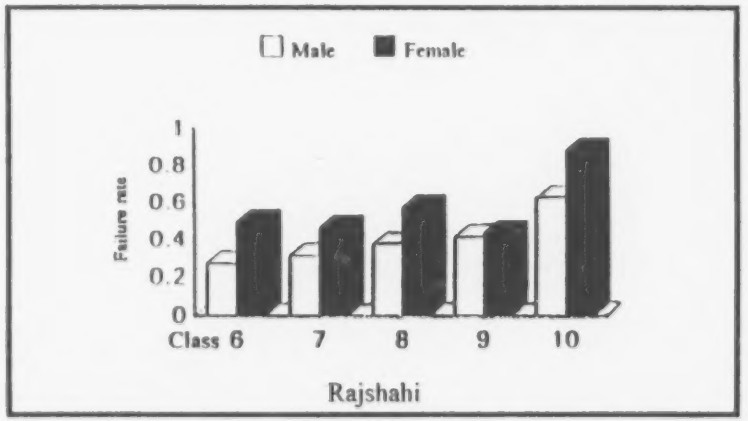
Source: School survey data, 1991-92.

Figure 15: Secondary Failure Rate by Region and Gender









Source: School survey data, 1991-92.

APPENDIX

Fixed-effects estimates of outcomes for coed schools

Table B.1: Fixed-effects estimates of determinants of school performance for coed primary schools

Variable	Enrollment rate		Failure rate		Dropout rate	
	Male	Female	Male	Female	Male	Female
Distance from thana headquarters (kilometers)	-0.04 (-0.38)	-0.03 (-0.37)	0.00 (4.85)	0.00 (4.80)	0.00 (5.16)	0.01 (5.79)
How long the school is in operation (years)	0.08 (2.81)	0.09 (3.75)	0.00 (0.11)	-0.00 (-0.93)	-0.00 (-0.68)	-0.00 (-2.44)
Highest grade offered	8.22 (3.84)	5.84 (3.23)	0.00 (0.02)	-0.00 (-0.20)	0.06 (2.63)	0.09 (3.21)
Proportion of teachers with bachelor's degree and above	10.26 (2.73)	11.85 (3.75)	0.00 (0.10)	-0.00 (-0.18)	-0.03 (-0.99)	-0.02 (-0.50)
Proportion of female teachers in school	8.35 (2.92)	10.74 (4.47)	-0.02 (-1.97)	-0.01 (-1.38)	-0.02 (-1.03)	-0.01 (-0.58)
School type (1=govt., 0=others)	6.14 (2.77)	6.31 (3.39)	-0.01 (-1.04)	-0.01 (-0.76)	-0.04 (-2.07)	-0.04 (-1.99)
School has electricity? (1=yes, 0=no)	8.25 (2.85)	5.60 (2.30)	-0.00 (-0.40)	-0.00 (-0.09)	-0.08 (-3.34)	-0.05 (-2.09)
Water supply (1=yes, 0=no)	2.46 (1.73)	3.65 (3.05)	0.00 (0.03)	0.01 (1.06)	-0.02 (-1.53)	-0.01 (-1.02)
Proportion of total land irrigated in the village	5.6 (2.78)	5.90 (3.49)	-0.00 (-0.86)	-0.01 (-1.78)	-0.00 (-0.18)	-0.03 (-1.53)
Coed schools with separate toilets (1=yes, 0=no)	8.59 (4.08)	6.72 (3.79)	0.01 (1.22)	-0.00 (-0.30)	0.02 (1.49)	0.00 (0.28)
Adjusted R-squared	0.10	0.13	0.03	0.02	0.04	0.05
F-statistics	9.70	12.63	3.19	2.37	4.34	4.54
Number of observations	1,275	1,275	1,206	1,198	1,206	1,198

Note: Figures in parentheses are t-statistics.
Source: Author's calculations.

Table B.2: Fixed-effects estimates of determinants of school-level outcomes for coed schools, secondary and above

Variable	Enrollment rate		Failure rate		Dropout rate	
	Male	Female	Male	Female	Male	Female
Distance from thana headquarters (kilometers)	-0.09 (-0.32)	0.35 (2.74)	-0.00 (-0.80)	-0.00 (-1.55)	-0.00 (-0.85)	0.00 (0.13)
How long the school is in operation (years)	0.57 (6.15)	0.19 (4.52)	-0.00 (-2.10)	-0.00 (-3.58)	0.00 (1.49)	0.00 (0.23)
Highest grade offered	7.30 (4.84)	1.05 (1.57)	0.05 (0.44)	-0.00 (-0.28)	0.01 (2.40)	0.01 (1.10)
Proportion of teachers with B.Ed/M.Ed degree	-11.19 (-1.21)	0.40 (0.10)	-0.02 (-2.41)	-0.01 (-0.89)	-0.01 (-0.54)	0.00 (0.14)
Proportion of teachers with bachelor's degree and above	60.88 (4.24)	27.33 (4.27)	-0.01 (-1.19)	-0.03 (-1.65)	-0.15 (-5.41)	-0.20 (-4.72)
Proportion of female teachers in school	32.15 (2.23)	40.11 (6.25)	-0.03 (-0.24)	-0.03 (-1.77)	0.04 (1.50)	0.02 (0.53)
School type (1=govt., 0=others)	154.89 (16.43)	41.92 (9.97)	-0.02 (-1.11)	-0.03 (-0.95)	-0.05 (-1.09)	-0.04 (-0.55)
School has electricity? (1=yes, 0=no)	17.02 (4.15)	2.79 (1.53)	-0.01 (-3.44)	-0.01 (-2.71)	-0.02 (-2.41)	-0.04 (-3.45)
Water supply (1=yes, 0=no)	4.01 (0.46)	0.31 (0.08)	0.01 (1.62)	0.01 (1.15)	0.05 (3.08)	0.01 (0.50)
Proportion of total land irrigated in the village	12.82 (2.34)	3.80 (1.56)	-0.00 (-0.65)	-0.01 (-2.02)	-0.03 (-2.52)	-0.03 (-1.81)
Coed schools with separate toilets (1=yes, 0=no)	-2.29 (-0.51)	1.01 (0.51)	0.00 (1.41)	0.02 (2.91)	-0.01 (-1.69)	-0.00 (-0.38)
Adjusted R-squared	0.33	0.16	0.02	0.02	0.05	0.03
F-statistics	35.87	14.74	2.60	2.51	4.28	3.14
Number of observations	1,696	1,696	1,512	1,450	1,512	1,450

Note: Figures in parentheses are t-statistics.
Source: Author's calculations.

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